Conference Abstracts

National HE STEM Programme Conference

4 – 6 September 2012, Birmingham
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Introduction

Welcome to the National HE STEM Programme Conference at the University of Birmingham. One of the primary objectives of the Programme is to encourage the sharing and dissemination of good practice and facilitate its wider uptake, and this major event is intended to showcase and disseminate the learning from this three year initiative established by the Higher Education Funding Councils for England and Wales.

In addition to a wide range of symposia, workshops and paper presentations, abstracts for which are detailed later in this booklet, there is an extensive poster display within the College of Arts and Law and well as the exhibition area in the Great Hall. We hope you will take every opportunity to explore the wide range of work that has been undertaken through the Programme and consider how you might adopt or further develop the activities, resources and approaches that are presented at this conference. We also encourage you to network with others at the conference, and we have designed the structure of the conference, including the evening sessions to encourage this.

It is through networking and the sharing of experiences and ideas that we can not only help ensure a legacy for the Programme, but also ensure that this conference marks the start of a new period of development and activity within the higher education science, technology, engineering and mathematics sector.

Although the Programme formally concluded its activities on the 31 July 2012, we will continue to develop the National HE STEM Programme website: [www.hestem.ac.uk](http://www.hestem.ac.uk) over the coming months to ensure the latest information, learning and resources from all projects are freely available to the sector.
List of Conference Exhibitors

The National HE STEM Programme

- Programme Hub (University of Birmingham)
- London and the South East Spoke (University of Southampton)
- Midlands and East Anglia Spoke (University of Birmingham)
- North East Spoke (University of Bradford)
- North West Spoke (Manchester Metropolitan University)
- South West Spoke (University of Bath)
- Wales Spoke (Wales Institute of Mathematical and Computational Sciences)

- Institute of Mathematics and its Applications
- Institute of Physics
- Royal Society of Chemistry

The Higher Education Academy

Lego Education

The National STEM Centre

Science made Simple

STEMNET
Keynote Speaker Biographies

Professor Lord Robert Winston

Lord Winston, Professor of Science and Society and Emeritus Professor of Fertility Studies at Imperial College, runs a research programme in the Institute of Reproductive and Developmental Biology, on improvements in transgenic technology in animal models, with a long-term aim of improving human transplantation. He has around 300 scientific publications in peer-review journals on reproduction and embryology. He is also Chancellor of Sheffield Hallam University, Chairman of the Royal College of Music, and was voted "Peer of the Year" by his fellow Parliamentarians in June 2008 for his expertise and work on the Human Fertilisation and Embryology Bill.

Robert Winston has been a visiting professor at a number of American, Australian and European universities. He was Chairman of the British Fertility Society 1984-87 and Dean of the Institute of Obstetrics and Gynaecology 1989-97. He was President of the British Association for the Advancement of Science in 2005. He is currently a member of Council and Chairman of the Societal Issues Panel at the Engineering and Physical Sciences Research Council.

His activities in the House of Lords include speaking regularly on education, science, medicine and the arts. He was Chairman of the Lords Select Committee on Science and Technology 1999-2002, initiating enquiries into Antibiotic Resistance, Non-Food Crops, Nuclear Waste, Science and Society, Genetic Databases, Aircraft Passenger Environment, and Science in Schools. He is a board member and Vice-chairman of the Parliamentary Office of Science and Technology.

Robert Winston is committed to scientific education and regularly writes or hosts popular science programmes for the BBC’s main channel, the Discovery and ABC networks. His many television series on different aspects of science have been shown in many countries overseas. Perhaps the best known is 'The Human Body' which won a record of three BAFTAs, an Emmy nomination and a Peabody award. Robert Winston has published fourteen books for lay readership: 'What Makes Me Me' won the Aventis Prize in 2005, and 'The Human Mind' was short-listed for the same prize in that year. 'Human' won the BMA First Prize for the Best Popular Medicine Book in 2005. "It's Elementary" was shortlisted for the Aventis prize in 2008. He regularly gives seminars in schools and universities.
Meg Munn MP
First elected Member of Parliament for Sheffield Heeley 2001.

Meg joined the Labour Party when she was 15, becoming a Nottingham City Councillor 1987–91. She is a member of the Co-operative Party, and is a Labour and Co-operative Member of Parliament.

As Minister for Women & Equality Meg took a great interest in the situation of women at work, an interest she continues – she provided the Foreword to ‘Diversity and the Economy’ (2006) and has recently edited ‘Unlocking Potential: perspectives on women in science, engineering & technology’ (2011).

Meg holds an MA in Social Work from the University of Nottingham and a Certificate and Diploma in Management Studies from the Open University. She is the first MP to be awarded Chartered Management Status from the Chartered Management Institute.

Meg is currently working with education and business leaders in South Yorkshire to make the region first choice for female scientists, engineers and technologists.

Sir Alan Langlands FRSE
Alan Langlands is the Chief Executive of the Higher Education Funding Council for England, responsible for promoting and funding high-quality education and research in universities and colleges with higher education programmes.

He was formerly the Principal and Vice-Chancellor of the University of Dundee (2000 to 2009) and Chief Executive of the NHS in England (1994 to 2000). He has a particular interest in the scientific basis of health services, and until 2012, he chaired the board of UK Biobank. He continues to chair the board of the Health Foundation and is a co-opted member of the Office for the Strategic Coordination of Health Research. Alan was knighted in 1998 for his services to the NHS, is a Fellow of the Royal Society of Edinburgh, and an Honorary Fellow of the Academy of Medical Sciences.

Alan was awarded an honorary doctorate by the University of Glasgow in 2001, and has honorary degrees from the Universities of Dundee and Edinburgh and the National Institute of Technology, Jalandhar, India. He has also been awarded several Honorary Fellowships.
Abstracts: Paper Presentations
(Presented Alphabetically by Lead Author)
Commercialising innovation within STEM disciplines – Defining and implementing experiential pedagogies for enterprise awareness

Stuart Abbott, Cardiff University
Neil Coles, Cardiff University
Jeremy Hall, Cardiff University

Session Type: Paper Presentation
Abstract Number: 77

This paper will describe project outputs and experiences of Cardiff University in identifying and implementing best practice in the provision of a higher education enterprise education module across STEM disciplines as part of the National HE STEM Programme project ‘Developing Enterprising STEM Undergraduates’. Authored with the intention of multidisciplinary application, the design, development, delivery and evaluation of the ‘Commercialising Innovation’ module adopted an experimental and investigative approach towards employing recent theoretical and policy-based contributions to best practice in the fields of STEM and enterprise education.

From a practical perspective, the paper will draw conclusions regarding the National HE STEM Programme project impact criteria whilst reflecting more broadly on related teaching and learning debates. In particular it will consider the function and practical application of experiential and problem based learning in implementing innovative enterprise education pedagogies with a view to engendering ‘commercially aware’ STEM undergraduates. The paper will draw on Cardiff University’s practical experience of planning and delivering the above module; academic discussions regarding the development of key skills, and enterprise and employability skills agendas; recent contributions and guidance regarding the pedagogy of enterprise education from professional and regulatory bodies.
Engaging employers and schools to support and facilitate the promotion of Civil Engineering courses among female students

Amir Alani, University of Greenwich
Christina Lucchini, University of Greenwich

Session Type: Paper Presentation & Poster
Abstract Number: 74

This project’s main objective is to engage employers within the civil and construction sector working in partnership with the Department of Civil Engineering at the University of Greenwich as well as schools and colleges within the Kent region to promote the study of civil engineering related courses/programmes amongst female students. This project also proposed to raise funding from its partners and sponsors (mainly Atkins Global) to sponsor individual female students financially as well as providing mentoring and guidance throughout their studies.

As part of its deliverables this project endeavoured to attract a group of female civil and construction engineering practitioners to participate as mentors to female students for the duration of their studies. The measurable outcomes of this project have included the creation of an original and innovative partnership between the University of Greenwich, construction industry and schools and colleges within the region. It will also result in developing publicity and marketing materials created for a specific purpose that could be disseminated and used by others. This project ultimately aims to secure high attaining and focused female students studying Civil and Construction Engineering related subjects at University of Greenwich.

This project highlights a significant and current issue within the engineering sector as a whole and the Civil and Construction industry in particular.
Insights from the Coventry University and Nuffield Foundation partnership for successful STEM outreach in the West Midlands

Farzana Aslam, Coventry University

Session Type: Paper Presentation
Abstract Number; 57

The session will showcase the Nuffield Science Bursary programme for AS-Level students. Nuffield Bursaries programme works closely in partnership with HE to address widening participation, for example through ‘Realising Opportunities’ and a concrete example is with Coventry University.

Students in the first year of a post-16 science, technology, engineering and maths (STEM) course are eligible to apply for a bursary of £80 per week to support them during their 4-6 week project. Placements are available across the UK, in universities, industry or research institutions. The students from schools in difficult social circumstances are particularly encourage, and students who do not have a family background of higher education or STEM professions.

The partnership between Coventry University and Nuffield Foundation started through ‘More Maths Grads - Nuffield Bursaries’ and has developed further into offering STEM bursaries across the West Midlands. These bursaries give students a chance to work alongside practising STEM professionals, an insight into STEM careers and a chance to contribute to research or development projects in universities, industry, field centres and research institutions.

The data and analysis collected to target schools will also be presented. A pilot mentoring programme through Coventry University to deliver throughout the West Midlands to support disadvantaged students to compete for and take full advantage of the bursary programme will also be highlighted.
Improving employment prospects of Engineering graduates

Helen Atkinson, University of Leicester
Martin Pennington

Session Type: Paper Presentation
Abstract Number: 79

Engineering employers say publicly at national level that they need more engineering graduates. Surveys by, for example, the Engineering Employers Federation, prove this. So why is there an almost 13% unemployment rate for engineering graduates (HESA data July 2010) with, in addition, a proportion of graduates employed in non-graduate level jobs? Whilst some disciplines have a higher unemployment rate (e.g. Computer Science 16.5%), others, including STEM subjects, have a lower rate (e.g. Chemistry 9.2%; Maths 10.4%; Physics/Astronomy 11.8%). Employability has received a huge amount of attention but there is a distinct issue here about why some engineers do not get graduate level work within a short time of graduation.

This paper will examine the findings of a Midlands Universities-based study focused on interviewing unemployed engineering graduates. The study investigates key issues that may have impeded employment at graduate level providing us with a relevant context to consider: “How can universities further improve what they do to help engineering students gain graduate level employment shortly after graduation?”
Development of a small-scale teaching centrifuge

Jonathan Black, University of Sheffield
Sam Clarke, University of Sheffield

Session Type: Paper Presentation
Abstract Number: 100

Geotechnical Engineering is a core area of the Civil Engineering discipline and is concerned with safe and sensitive transformation of our natural environment to support infrastructure developments that underpins modern society. Laboratory practical session are frequently used to evaluate soil behaviour and strength under different stress levels; however, it is exceedingly difficult to demonstrate the effects of gravity in the laboratory for routine design applications such as a slope stability, retaining walls and foundations as the appropriate prototype self weight stresses are not reproduced in small bench scale models. While reduced-scale, physical models at 1g can provide a basic overview of these problems, they fail to reproduce the subtleties of behaviour and realistic failure mechanism observed at full scale due to self weight gravity dependent processes.

A geotechnical centrifuge produces a high gravitation environment which enables realistic self-weight–induced stresses and strain distributions in small scale models similar to that of a field situation. The cost and size of research centrifuge platforms often prohibits their introduction into the undergraduate curriculum and thus the development of a small scale teaching centrifuge would be a distinct advantage to support undergraduate learning. This paper documents the development of a cost effective small scale teaching centrifuge at the University of Sheffield to enhance the delivery of geotechnical engineering principles linking theory and design through physical modelling. The state of the art system has been constructed from off-the-shelf components, and incorporates a ‘how-to’ development guide for the manufacture of this technology and associated learning/design resources. A range of learning resources addressing a range of practical design problems are described and the benefits to undergraduate students are evaluated.
Developing professional skills through short-term engineering placements

Martin Borthwick, Plymouth University
Elizabeth Vincent, Plymouth University

Session Type: Paper Presentation
Abstract Number: 51

The benefits of industrial experience for undergraduate engineering students are well known, particularly for improved graduate employability in the competitive market place. This has led to increased competition for a limited number of traditional one-year sandwich placements, particularly during the recession.

This study, sponsored by the Royal Academy of Engineering, investigated the viability of short-term industrial placements (during summer vacations) as an alternative means of developing professional skills for engineering students. It examined the capacity for engineering employers to accommodate short-term placements; and identified the potential skills developed, so that such placements can have measurable outcomes rather than simply experience.

Of 112 companies contacted one-third provided feedback through face-to-face meetings and telephone interviews for their opinion of short-term placements and the range and extent of professional skills that students could develop. A ‘Skills Tracker’ to assist students in preparing and reviewing their short-term placements was piloted by a group of students and reviewed by the employer group. Whilst the study involved a wide range of civil and mechanical engineering employers, the outcomes are relevant across the STEM disciplines and show clearly the advantages of short term placements to both students and employers.
Designing the future – Project findings and updating the action plan

Denise Bower, University of Leeds
Nancy Madter, University of Leeds

Session Type: Paper Presentation
Abstract Number: 76

The current high level of debate across government, industry, the professional bodies and Higher Education reflects the changing role of engineering in society. This has led those responsible for the education and training of engineers to question: is there sufficient supply into the industry and do those engineers have the skills to tackle social challenges? In response, Engineering Educators have participated in collaborative discussion regarding the portfolio of programmes, how they should be delivered and how they can engage industry to get the reality and excitement of engineering into the 21st Century classroom. From this discussion, an action plan for sustaining the outputs has been developed along with efforts to disseminate good practice staffing models, innovative learning environments and plans for future sharing. Initiatives will be taken forward by the HEA via their STEM special interest group to strategically consider and guide future developments in Engineering Education. This session will focus on the dissemination of the project findings and further contributions for updating the road-map for the future.
Applied Physics at the University of Bradford

Elaine Brown, University of Bradford
Nazira Karodia, University of Bradford

Session Type: Paper Presentation
Abstract Number: 83

The University of Bradford has established new undergraduate BSc and MPhys programmes in Applied Physics, supported by the National HE STEM Programme.

The proposed curricula are complementary to the courses currently offered by the School of Engineering, Design and Technology (EDT). Applied Physics broadens the cohort of students studying physics at undergraduate degree level, extends the education portfolio offered to prospective Bradford students and enriches our undergraduate skillset. The programmes will widen participation to include those who explicitly prefer to incorporate both engineering and science in their chosen study, and will strengthen the STEM provision at Bradford. The Institute of Physics (IOP) is working with Universities and employers to develop appropriate curricula, and has strongly encouraged the implementation of Applied Physics undergraduate programmes, with specific interest in the Bradford offer.

Curriculum developments have incorporated new and innovative teaching methods including problem-based and technology-enhanced learning, and have canvassed the opinions of professional and industrial advisors. Applied Physics complements the research interests and academic expertise at Bradford; staff involved have world class research portfolios in diverse areas including healthcare, pharmaceutical and medical technologies, advanced materials, micro and nanotechnology, telecommunications, electronics and embedded systems, environmental design, sustainable living, and modern infrastructures.
A regional approach to widening access - STEM subjects at level 3

Andrew Burns, Swansea University
Heather Pudner, Swansea University

Session Type: Paper Presentation
Abstract Number: 48

This paper will outline the regional approaches and advances made by the South West Wales Reaching Wider Partnership over the last two years to widen access to STEM subjects for young people from targeted backgrounds. The paper will highlight the university visits and residential opportunities that the partnership has used to create viable and accessible pathways at level 3 that allow students to progress comfortably to level 4 studies in STEM subjects.

By taking a partnership based regional approach to widening participation across the academic lifecycle of people in ‘Communities First’ areas of high relative poverty and low participation in higher education the partnership aims to increase their levels of enrolment in HE. Young people from the four south-western counties of Pembrokeshire, Carmarthenshire, Swansea and Neath Port Talbot were invited to participate in events which were designed to enhance their STEM A-Level studies and raise their grades. Using academics from HE and resources that are not commonly available in FE and schools the aim is to raise levels of motivation and interest in the young people concerned.

The project has utilised internal colleagues and external partners who have an interest in Widening Participation for delivery and worked in collaboration with Learned Societies, such as the Institute of Physics (IOP) and the Royal Society of Chemistry (RSC). Major external contributors have included the Abertawe Bro Morgannwg University Health Board and Careers Wales West, who donated their time and expertise to assist with coordination and facilitation of planning and teaching the provision.
On-line tools for supporting group-work in a large cohort

Patricia Campbell, University of Manchester
Jonathan Sly, University of Manchester

Session Type: Paper Presentation
Abstract Number: 50

This presentation will describe our experience of using on-line group pages and tools, such as wikis and electronic journals for group-work in two integrated course units at the University of Manchester. After a brief explanation of the reasons for our innovation, the benefits and challenges of using these tools will be explored.

The principal benefit of on-line group pages is that they can limit access to the members of a particular group of students; this gives the students the confidence to share work in a ‘semi-public’ space. In this environment, the use of wikis for submission of student work and tutor feedback was very positively received by students. Electronic journals were used for the monitoring of group project work over a two semester period; they proved an effective tool for managing our large cohort (280 students). Student presentations were filmed and then made available via the group pages: student feedback on this will be reported. Some of the on-going challenges will also be explored.

Having experimented with the use of on-line group pages and tools over a two-year period, we are currently investigating student practices and preferences for working on-line; key findings of this research will be presented.
Can the employability of undergraduates be enhanced through raising curriculum content awareness and relevance in the workplace?

Sophie Carr, Northumbria University  
Julie Edgar, Northumbria University  
Lucy Probyn, Northumbria University

Session Type: Paper Presentation  
Abstract Number: 28

By reviewing academic curriculum and key skills attributed to a programme employers and academics can influence programme design to support students and enable them to best present themselves and demonstrate the key attributes and professional skills that the employer requires. Following several employer meetings and communications it quickly became evident that broad employability skills were of greater importance to the employer than professional proficiencies aligned to academic studies. Employers were really looking beyond a qualification to find an employee that fits well with their employer working environment. As such, evidence of team working, planning and organisation, numeracy, self management, problem solving and communication were highest on an employers list of requirements.

Given the emphasis employers placed on professional behavioural skills during the recruitment process the focus of the project was on areas areas likely to have greatest impact on student employability. In addition academic programme competencies and professional/ behavioural skills were mapped to employer needs, ensuring coherence and clarity for the student. The project was entitled ‘Job Ready’ and comprised a series of voluntary attendance lectures, events and supporting materials designed to raise student’s awareness of their own skills and those that are valued by an employer (as highlighted above). The Job Ready project also sought to motivate students to take early responsibility for their future employment and realise the varied career opportunities available to them.

A review of student engagement and perceived student benefits will be discussed together with the opportunity for the delivery of generic employability resources and shared best practice. The resulting legacy includes a pilot package of lectures, events, materials and delivery methods which will be used on a wider scale across a greater number of university departments in following academic year – it is envisaged that this will ultimately be developed into University Best Practice Advice for dissemination.
Case Studies on Employer Engagement in Mathematics at Higher Educational Institutions

Edmund Chadwick, University of Salford
Makhan Singh, Institute of Mathematics and its Applications

Session Type: Paper Presentation
Abstract Number: 129

The aims and objectives of the session are to bring to the attention of the audience 12 case studies where employer engagement in mathematics has taken place at universities. The case studies describe the activity and indicate what is required to undertake it. It is hoped that the audience will be inspired by them to try to adopt the practice within their own institution.

This work collates employer engagement activities in mathematics at partner Higher Education Institutes (HEIs), with the intention of encouraging other HEIs to adopt the practice, spreading take up and fostering employer engagement in mathematics. As such, the work is primarily for those HEIs looking to adopt in their own institutions exciting and innovative ideas on employer engagement.
Assessing Engineering competencies: What can be learnt from the medical professions?

Robin Clark, Aston University
Jane Andrews, Aston University

Session Type: Paper Presentation
Abstract Number: 72

Difficulties with assessing and evaluating professional competencies in engineering are recorded in the literature. Such difficulties range from problems in aligning learning outcomes so as to inform curriculum development, to questions of how to develop assessment approaches which meet the need for students to achieve the prerequisite level of competencies required by Employers, Professional Bodies and Academia. By investigating how professional competencies are assessed in both Engineering and in the Medical Professions, the various pedagogical approaches utilized within each discipline are critiqued. In doing so the presentation considers what, and how, the two disciplines can learn from each in terms of developing and enhancing the student learning experience in such a way so as to improve the assessment of key competencies.

The discussion will focus on two main themes:

1. A comparison of the strengths & challenges of assessing professional competencies in the Medical and Engineering discipline - ‘What works’ and why in both disciplines

2. How techniques and processes in both disciplines may be adopted and adapted to improve students’ experiences in engineering education - Building on the study findings
Developing STEM up-skilling services for the process industries in the North-West

Michael Cole, Manchester Metropolitan University
Paul Schofield, Manchester Metropolitan University

Session Type: Paper Presentation
Abstract Number: 64

The Manchester Metropolitan University National HE STEM Programme Legacy Project has focused on developing a systematic approach to identify the workforce up-skilling needs in the process industries. This has involved the development of up-skilling resources with direct and flexible delivery methods that incorporate new distance learning provisions. The session will present the results of a “skills needs analysis” drawn from existing market intelligence. The session will also present a “skills matrix” compiled within the project to highlight the current HEI, FEC provision within the region.

Based upon the data from these two studies we will describe how we have developed new working relationships with FECs and professional service providers to bridge the knowledge gap and extend HE accredited training provision. Examples of new blended e-Learning materials will be showcased, based upon novel distance learning material. These materials have been used extensively in both commercial and non-commercial environments. Experiences of setting up commercial CPD training and the sustainability of a CPD programme within a large HEI will also be discussed and it is hoped to facilitate a discussion on the sustainability of STEM legacy activities via income generation.
SYMBoL: Reflections on a large-scale curriculum development project

Tony Croft, Loughborough University

Session Type: Paper Presentation
Abstract Number: 71

Previous research has documented the challenges of motivating and retaining the interest and enthusiasm of undergraduate mathematicians once they reach the second year. The SYMBoL project (Second Year Mathematics BeyOnd Lectures) sought to address some of these challenges, in respect of two specific mathematics modules, by involving second year students in critical reviews of resources provided by the lecturers for student use, in creating additional resources of their own, and soliciting and reporting upon feedback from students. In the following year some of these students, by then in year 3, worked as peer mentors, offering support and guidance to the current second years.

There are lots of positive outcomes from the SYMBoL project, but this talk will reflect upon the issues and challenges faced in bringing it about within the constraints of a research intensive department where there are tensions and competing demands upon staff time. Some effects on the wider institution and aspects of the project adoption at other institutions will be discussed.
Part-time students as a resource

John Davies, Coventry University

Session Type: Paper Presentation
Abstract Number: 15

The session will summarise three National HE STEM Programme projects which had contrasting aims but a common area of interest. It will:

- consider the outcomes of each project (including evaluation)
- demonstrate how, taken together, the projects have made a valuable contribution
- propose how the findings should be used

The first project, ‘Using part-time students as mentors’, involved setting up a scheme for civil engineering students at Coventry in which part-timers with up-to-date experience of the industry acted as mentors to full-time first year students. The practice has been developed during the second year of operation at Coventry, and in 2012 has been adopted by three other universities.

The second project, ‘Part-time students in the workforce - enhancing practice in course provision and increasing participation’ is a collaboration between four universities aimed at producing guidance for those seeking to enhance or adapt existing part-time provision, or to create new provision, and a strategy to increase the take-up of part-time study.

The third project, ‘Cognitive apprenticeship meets industrial apprenticeship’, is a study of the experiences of part-time students on realistic project work designed to develop professional attributes that they may already, in part, have developed in the workplace.
Stimulating Physics through employer engagement

Martin Dawson, University of Salford
Ian Morrison, University of Salford
Richard Pilkington, University of Salford
Jenny Warburton, University of Salford

Session Type: Paper Presentation
Abstract Number: 95

As part of the Stimulating Physics programme, the University of Salford has developed a new curriculum including a focus on employer awareness and employability from an early stage. This includes the implementation of a new module comprising a series of group-mini-projects alongside a seminar series in which employers of physicists give seminars covering a wide variety of career opportunities available to physics graduates.

The projects are open-ended – allowing students some flexibility in choosing the direction – but are designed to help develop skills including research methods, project planning, experimental design and work presentation: skills essential for the larger-scale projects that students face in the second and third years of study.

In this paper we outline various types of projects and discuss their various merit and student opinion of the module. We find student opinion on the module to be divided depending on personal views of relevance, necessity, purpose and enjoyment. Many find the continuous assessment and lack a “correct method/solution” frustrating, and much prefer the definitiveness of the lectures-plus-exam approach to teaching and learning. However, the enrichment of the students’ experience and the overall benefits are clear; students’ ability to simulate, organise and communicate information contrasts starkly between the beginning and end of the course.

We also discuss the continuation of the theme into later years in the form of industrially-relevant/informed group projects.
The development of a sustainable approach to learner-employer engagement

Paul Denton, University of Huddersfield
Richard Brown, Bradford College
Eric Morgan, University of Bradford

Session Type: Paper Presentation
Abstract Number: 96

In today’s competitive workplace, it is vital that graduates are equipped with the professional skills to succeed in industry. Yet, it is commonly acknowledged that undergraduate learners often lack the competencies necessary to make a smooth transition into industry. Indeed, the Lambert Review exposed the difficult interface between academia and industry, with this being particularly relevant to Yorkshire & Humberside (Y&H), where only six per cent of employers have any contact with higher education. In response, this project aims to address these issues by designing, developing and piloting a professional learner/employer engagement approach and impact evaluation model, which includes industrial mentor training.

The model was constructed upon a capability maturity foundation and built from employer engagement and learner Information, Advice and Guidance (IAG) research. From analysis of this research, a focused range of sustainable, short courses were developed and embedded into existing curriculum to enhance learner’s industrial readiness and employability. In parallel, an integrated partnership of academic institutions, specialist training providers and professional bodies, supported the increased provision of student placements and initiated the development of an accredited, industrial mentors course to further improve collaboration depth.

This paper initially examines research findings from the work, prior to the presentation and evaluation of results attained from the pilot implementation of the model.
Developing Applied Physics at Portsmouth

Chris Dewdney, University of Portsmouth

Session Type: Paper Presentation
Abstract Number: 40

In September 2010 Portsmouth University started a new degree in Applied Physics. The degree was initially developed by a collaborative team drawn from staff in both the Technology and the Science faculties. The degree has been further developed through collaboration with industrial and public sector organizations. The core of the degree has been focused on developing sustainable curriculum materials for a new approach to the laboratory and case-study-based applications units in levels 4 and 5 and the major project and field trip at level 6.

The curriculum is founded on developing technical, analytical and problem solving skills and knowledge motivated by real-world problems such as arise in industry or research.

The project has aimed to incorporate good practice, informed for example by the HEA PossiBiLities and Employability studies, Institute of Physics University of Salford project, SEPnet experience, amongst others. Industrial and commercial partners have also been engaged in the delivery of the degree. Students, who otherwise may not have had the opportunity to study physics, have gained valuable experience of the application of physics in wealth creation and human health and enhanced their employability through the acquisition of vital skills that should ease the transition to employment.

The aim of this presentation is to provide a critically reflective account of the context and the processes of development and implementation of the degree and its curriculum.
This paper describes a project which explores the problems experienced by students making the move from college to university in becoming first year engineering degree students. This transfer is typically a significant and often daunting change, the major aspect of which is the different ways in which students are expected to learn and the methods used to teach and assess them.

The aim of the project was to map the BTEC National Diploma in Engineering and the Advanced Diploma in Engineering curricula against the University’s Level 1 Engineering provision and in so doing informs Level 1 module design and delivery in relation to these students’ prior knowledge and understanding. This, it was believed would help to acclimatize incoming students to the University’s approach to teaching learning and assessment and enhance their learning experience.

To this end an experienced engineering lecturer from a local FE college was appointed as a Teacher Fellow who attended the University on a regular weekly basis. Through the use of semi-structured interviews, focus groups and classroom observations the experiences and expectations of first year engineering students were explored and analysed. The findings, outcomes and recommendations of this ongoing project will be discussed in the presentation.
Mathematics module design and delivery: Not your module but our module

Francis Duah, Loughborough University
Tony Croft, Mathematics Education Centre, Loughborough University

Session Type: Paper Presentation
Abstract Number: 105

In the 2010/2011 academic year, the School of Mathematics at Loughborough University secured National HE STEM Programme support to redesign two of its historically problematic modules, Vector Spaces and Complex Variables. The aim of the project was to enhance the second year undergraduate mathematics experience, increase student engagement and satisfaction with mathematics so that they leave reporting increased satisfaction with their learning experience. The project was a collaboration between staff and students in designing teaching and learning resources for the two modules. This paper describes the curriculum development process and the collaboration between staff and students in designing teaching and learning resources for the two modules and providing peer assisted learning support to second year students.

A unique feature of the project was the active participation of four students in the design of the modules. This paper reports on the students’ role, experiences, and their working relationship with staff. The paper provides detailed insights into the benefits that accrued to the students and barriers to their involvement as partners with staff. Furthermore, the paper describes the resources produced and their potential impact on student engagement with mathematics.
Developing maths support from scratch

Ant Edwards, University of York

Session Type: Paper Presentation
Abstract Number: 33

In 2009 the sigma centre of excellence in the provision of mathematics and statistics support, a delivery partner of the National HE STEM Programme, provided start-up funding for the University of York to set up a mathematics support service: the Maths Skills Centre.

In its first year of operation (2010/11), York’s Maths Skills Centre offered algebra and calculus assistance for first-year science students. It was visited 731 times by 163 students and had received very positive feedback from students. Additional internal funding then expanded its remit in 2011/12 to provide support for all first year undergraduates in their mathematics and statistics, together with basic statistics training for postgraduates. In the year to come, there are plans to expand further still.

This paper will chart the progress made and challenges met in setting up mathematics support from scratch. The topics it will cover topics will be relevant to both existent and proposed mathematics support services, with examples given in the context of York’s provision and elsewhere in the sector. Topics will include:

- Advertising the service to students
- Informing staff and managing staff views of appropriate support
- Automated data collection and analysis
- Evaluation of maths support
- Development of a sustainable business plan
Sustainability challenge, starter for ten: 2 university libraries, 1 corporate sponsor and 4 student ambassadors

Ginny Franklin, Loughborough University
Carol Hollier, University of Nottingham

Session Type: Paper Presentation
Abstract Number: 11

A successfully funded project at Loughborough University Library in 2010/11 employed four student ambassadors: one each for the faculties of engineering and science and two for the larger social sciences and humanities faculty. The ambassadors, paid at student rates, were asked to solicit feedback from their peers on Library-related issues and to respond with a creative marketing campaign that would appeal to students. In the absence of continued project funding the challenge was to make the initiative sustainable.

In 2011/12 Loughborough University in conjunction with the University of Nottingham were supported via the National HE STEM Programme to develop and test a model to hire students on a low-cost or no-cost basis. Two STEM students at each institution were recruited to promote the respective Library services whilst an industrial sponsor provided a performance-related remuneration package in lieu of a salary.

This paper outlines the outcomes to date of the project as well as plans for the future.
Schools outreach: a method of recruiting HE students into teaching

Phil Furneaux, Lancaster University
Chris Lawson, Lancaster University

Session Type: Paper Presentation
Abstract Number: 8

This presentation will suggest how the HEIs can use outreach/engagement activities to improve the personal skills of graduate and postgraduate students that could prepare them for teaching in schools.

Lancaster Physics Department has developed a schools outreach programme where postgraduates are central to the delivery through experiment demonstration and short talks about their research. The events are continuously evolving using participant questionnaires and discussion which the outreach team and now they are regularly rated at 4/5 or above.

The employment of a Teaching Fellow supported by the Ogden Trust has brought about a culture shift in the department, as the academic staff now accept that schools outreach is not only valuable to promoting physics, but also help with evidence of impact cases for REF reports. The Department is now building up resources to support public engagement and schools outreach through a sustainable fund.

Case studies will be presented of postgraduates and undergraduates who have been involved in schools outreach and are now on a teaching career path.
Improving mathematics support through on-nine diagnostics and student mentoring

Michael Gallimore, University of Lincoln

Session Type: Paper Presentation
Abstract Number: 21

The ever growing gap between secondary and university level mathematics is now becoming a major concern to higher education institutions. The increase in diversity of students' background in mathematics, from students who have studied the more traditional A-level programmes to students with BTEC or international qualifications and part-time students who have been out of education for long periods, means that they are often unprepared for the marked shift in levels and catering for all abilities is difficult in the normal lecture, or tutorial format.

Lack of sufficient mathematical knowledge not only affects students’ success on courses but also leads to disengagement and thus a high drop-out rate in the first 2 years of study. Many universities now offer a maths support service in an attempt to overcome this but their success is varied. The paper details a novel approach to mathematics support that utilises on-line diagnostic testing to facilitate continuous Assessment for Learning (AFL), Individual Learning Plans (ILP’s) as a method of tracking support requirements and a ‘student expert’ system to encourage peer-to-peer mentoring. The work builds on the current system adopted by the Lincoln School of Engineering which has been shown to significantly improve student retention, success and engagement.
National HE STEM Programme: Facilitating curriculum change and institutional impact in HE

David Greatbatch, Durham University
Harry Tolley, University of Nottingham
Helen Mackenzie, University of Leicester

Session Type: Paper Presentation
Abstract Number: 137

A core area of activity for the National HE STEM Programme has been directed towards facilitating curriculum change. Consequently, this study aimed to: develop a better understanding of the factors which bring about large-scale curriculum change that will be sustainable in the longer-term; offer a legacy from the Programme by providing evidence that can be used to inform future decision-making in relation to curriculum change; and, explore how it has helped to change institutional practices within HE.

The research began with an investigation into twelve large-scale curriculum enhancement projects. This was followed by the study of four projects (‘Teacher Fellows’, ‘Context and Problem Based Learning’, ‘Industrial Group Projects’ and, ‘Maths Support’), which sought to build upon earlier disciplinary pilots led by the Royal Society of Chemistry, the Institute of Physics and the Maths, Stats & OR Network. The final phase of the work examined the impact of the Programme on institutional practice within four HEIs.

Qualitative research methods were used throughout including the analysis of documentary evidence, interviews with key stakeholders and observation at relevant meetings and events.

The main outputs from the research will be a report and a briefing document for the benefit of the HE STEM sector.
Computer-aided assessment: technical and pedagogic issues that apply to STEM

Martin Greenhow, Department of Mathematical Sciences, Brunel University

Session Type: paper Presentation
Abstract Number: 87

The purpose of this paper is to disseminate what has been learned from setting computer-aided assessments (CAA) within elementary mathematics to a much wider audience in STEM and even beyond. This work has resulted in a package called maths e.g. that is freely available at: http://www.mathcentre.ac.uk:8081/mathseg/ for formative assessment use. This is proving popular, as is the teachers' interface http://www.mathcentre.ac.uk:8081/mathsegteacher/ whereby teachers/lecturers/others can easily set up their own tests by adding questions to a 'shopping trolley'. Both facilities are free and allow selection from around 2000 question styles, each producing to thousands or millions of realisations at runtime.

Since the question database spans numeracy/mathematics/statistics at GCSE, AS, A and first year undergraduate levels, as well as some coverage of programming and even communication, it will have wide applicability in a STEM context. Randoms are used within equations (via MathML) and diagrams (via SVG) on the fly, allow the user to set his/her own colour and size preferences. Questions and feedback can be viewed in over 50 languages.

Strategies for embedding CAA within the curricula and evaluating its efficacy will be discussed. Previous data from mathematics and service mathematics courses on the efficacy of using the current question database will be updated and conclusions drawn.
A student-led approach to enhancing undergraduate algebra

James Groves, University of Lancaster

Session Type: Paper Presentation
Abstract Number: 29

From 2012 the Department of Mathematics and Statistics at Lancaster University will be adopting the student-led methods project, developed by Professor Tony Croft at Loughborough University in 2011 through the National HE STEM Programme, to enhance its second year undergraduate module Groups and Rings. Our project has been funded by the National HE STEM Programme as part of its Practice Transfer Adopters scheme.

We will collect and evaluate focus group, interview and questionnaire data. We shall be employing five of our students as interns over four weeks in July 2012. Our interns will develop, in consultation with the Groups and Rings lecturers, enhanced course notes, enrichment materials, revision guides and visual aids. They will investigate how computer algebra packages could be incorporated into the course. Everything produced by our students will be reviewed as part of the project evaluation. This project will enable our students to have an active role in developing algebra teaching. It will give them a sense of ownership in our decision-making processes. We hope our students will start to see themselves as contributing members of our academic community, with significant input into their learning experience.

In this presentation we shall be reporting on our findings and sharing some of the materials we have created.
Addressing the Growing Industrial Skills Gap

Richard Hall, University of Wolverhampton
Sir Geoff Hampton, University of Wolverhampton
Professor Ian Oakes, University of Wolverhampton
Professor Geoff Layer, University of Wolverhampton

Session Type: Paper Presentation
Abstract Number: 133

High value manufacturing industry in the UK is currently growing at a significant rate. Some aerospace companies are recording 10-15% growth per annum, and Jaguar Land Rover are proving to be highly successful. Yet, companies are being held back in not being able to recruit people with the right skills. There is an aging work force, average skills levels are lower than in Europe; and, those that are qualified for the roles lack experience.

This paper presents a totally new approach (a paradigm shift) to bridging the skills gaps and providing education with the specific experience required for industrial roles. This new approach is scalable, allowing the numbers of learners to be geared-up, to tackle the growing skills gap. Dick Oliver CEO BAE Systems reports that, if unchecked, there will be deficit of 500,000 engineers by 2017.

With support from industry, government, FE, HE, and other partners a new concept of a National Skills Factory is suggested, for seamless progression of existing employees, and young people, to follow lifelong learning in a work environment. National Skills Factories could form hub and spoke physical sites at the heart of economic zones designated by the UK government. Young people would also be attracted to STEM subjects and related industrial sectors, by attractive sponsorship packages negating the need for student loans. Learners would be developed not only to have the academic skills, but will also have the practical experience in readiness for the workplace.

This pilot project presents significant challenges and institutional change for the Higher Education sector.
Engineering change in Engineering education: outcomes of the Royal Academy of Engineering’s strategy to support the National HE STEM development programme

Matthew Harrison, The Royal Academy of Engineering
Ivan Moore, The Royal Academy of Engineering
Hal Igarashi, The Royal Academy of Engineering
Sapna Somani, The Royal Academy of Engineering

Session Type: Paper Presentation
Abstract Number: 80

This paper presents the outcomes of a 3 year programme of work to support and influence changes to pedagogic practice in higher education engineering departments. The programme funded and supported 65 one-year projects in three phases. Projects were selected through a bidding process under four themes: curriculum innovation, engineering for society (which included widening participation, diversity and outreach), pedagogic research and employer engagement. A discussion of the scheme, with emphasis on the decisions made in selecting projects for funding, the process of managing the projects, is combined with an overview of the nature and scope of the projects selected. A meta-analysis and evaluation strategy provide useful lessons for the sector which will both inform practice in engineering education and inform future strategic interventions on a national scale.

Finally, the key outcomes of the programme will be presented. These include:

- effective mechanisms for encouraging, disseminating and recognizing enhancement activities in engineering education
- common issues recognized by the sector
- effective practices in addressing these issues
- models for engaging students, staff and employers in enhancement activities
Making engagement and collaboration work: Lessons learnt from the National HE STEM Programme

Susanne Haselgrove, Susanne Haselgrove and Associates

Session Type: Paper Presentation
Abstract Number: 138

This session presents the outcomes of the National HE STEM Programme synthesis project on engagement and collaboration; the wide range of engagement and collaboration will be mapped to illustrate the breadth of interactions between project partners and stakeholders. It will explore the factors which promoted this wide range of engagement and collaboration across widening participation, curriculum development and workforce development as well as what militated against it. It will explore the differences between the three main strands of activity and highlight the key factors at work.

The conclusions are based on a wide evidence base gathered from interviews with all the National HE STEM Programme partners as well as from analysis of documentary evidence and inputs from project leads. Recommendations will be made to sponsors of future projects as well as to university leaders and employers wanting to engage meaningfully with universities.
An innovative way of attracting young people to STEM careers at science and discovery centres

Kamel Hawwash, University of Birmingham
Annette Smart, University of Birmingham

Session Type: Paper Presentation
Abstract Number: 106

Young people visiting science museums or discovery centres leave good quality facilities excited about science and engineering but this is does not necessarily change their thinking about a career in these areas. There is a key opportunity to take their experience beyond the visit to help them, their parents and educators further explore STEM careers. This background has led to the development of a pilot project supported by the National HE STEM Programme which uses the most up to date technology of multi-user, multi-touch tables as a means of showcasing STEM careers, specifically linking their excitement about science and engineering, aspirations to pursue a STEM career and the role that higher education plays in taking the young people on that journey. At the heart of this are some 20 STEM role models from industry, teaching and HE. The National HE STEM Programme Midlands and East Anglia Spoke has brought this to reality by close collaboration with the National Space Centre in Leicester.

The aim of this paper is to disseminate the journey from concept to reality and to report on early impressions of the users. In addition a second innovation, the use of the ‘Look Deeper’ technology, brings the role models to life from a postcard making the information accessible anywhere at any time; functionality that young people expect in this time of dynamic communication.
Encouraging collaboration between school STEM Clubs and HEIs for sustainable benefit

Kamel Hawwash, University of Birmingham
Annette Smart, University of Birmingham

Session Type: Paper Presentation
Abstract Number: 107

This paper reports on a National HE STEM Programme Midlands and East Anglia project which set out to test the potential for creating sustainable links between HE, employers and the schools sector. There is a growing body of evidence that participation in STEM Club activities motivates students and teachers, and can have a significant impact on young people’s future choices for study and careers. The model adopted was based around linking a number of STEM clubs to an HEI. Clusters were set up in the West Midlands, East Midlands and East Anglia. The aim of the session is to share the experience gained in the Midlands and East Anglia region with colleagues from across the sector. It will report on the issues raised during the development phase and will highlight successes and report on failures to ensure key lessons are learnt.
Sharing good practice through peer review

Alison Hooper, University of the West of England

Session Type: Paper Presentation
Abstract Number: 12

The collaboration that arose from the National HE STEM Programme project *Constructing a Coherent STEM Strategy with Schools* between the University of the West of England and the University of Plymouth to embed good practice with respect to a coherent STEM approach to School Liaison is described. Project outputs included visits by university staff to view outreach event at the partner university and a pilot UWE STEM School Activity Day, which was based on a visit by UWE staff to a University of Plymouth STOP day.

The aims of the pilot UWE STEM School Activity Day were to inspire pupils with respect to STEM subjects, to encourage pupils to aspire to university to study STEM subjects, to promote future careers in science, engineering and mathematics and to connect and enhance the school curriculum.

The evaluation of the pilot UWE STEM Activity day indicated that the day was very successful with a positive response in regard to all aims. As a consequence UWE STEM Activity Days were rolled out to a further four schools in 2011, all of which received positive evaluation reports and plans are underway to run the Activity Day to four schools in 2012.
Employer engagement for upskilling the workforce in engineering SMEs

Tania Humphries-Smith, Bournemouth University

Session Type: Paper Presentation
Abstract Number: 13

This paper presents the development of an integrated programme entitled MEng Engineering that will provide an opportunity for engineers already in the workforce to engage with upskilling that can lead to their gaining professional recognition. Progression will be provided directly from HNC/HND/FdSc qualifications for engineers already in employment to gain BEng and MEng qualifications by part time distance learning mode.

The programme will be jointly delivered by Bournemouth University (BU) and Bournemouth and Poole College with the award being a BU award. The programme will be delivered in 2-6 years depending upon entry and exist points and amount of credits studied in an academic year. The programme has been developed through close discussion with various employer representatives.

It is the intention that the programme be submitted to the Institution of Engineering Designers (IED) for Engineering Council accreditation for the academic requirements of IEng/CEng as appropriate to level.
Enhancing student employability skills across the STEM disciplines: The Birmingham Grand Challenge Project

Jenny Illingsworth, University of Birmingham
Kamel Hawwash, University of Birmingham

Session Type: Paper Presentation
Abstract Number: 104

The Grand Challenge Project is a 4-week long intensive project delivered in the summer vacation to groups of students from across the STEM disciplines at the University of Birmingham. The Project was developed in 2010-11 and has run both in 2011 and 2012. The project combines the setting of a real open ended challenge for students to tackle in groups from across the STEM disciplines and includes a series of workshops aimed at reinforcing or developing employability skills. It has now been adopted by two other universities in the Midlands.

The overall aim of this paper is to disseminate the outcomes of project to the HE sector in the hope that it or a variation may be adopted more widely. The paper will provide the background to the project, an example of its typical structure and the experience the University has from having run it twice and having been involved in transferring it to two other universities in the region.
Bloodhound SSC – Open access user community model

Daniel Johns, University West England
Becky Sage, University West of England

Session Type: Paper Presentation
Abstract Number: 42

Bloodhound SSC (www.bloodhoundssc.com) is a Super-Sonic world land speed record project which will aim to achieve 1,000mph on land; however its primary mission is to inspire the next generation to study STEM subjects and build capacity for designing a low carbon future. In order to achieve this, the project has a committed Educational Program and built on an Open Source model to ensure the barriers of outreach are minimal, and that maximum impact is generated.

Many technology innovations will be relevant to the HE community, and so the University West of England and Southampton University have created the ‘Bloodhound Open Access User Community Model’ which captures, and then freely shares all aspects of the technical development to the HE community. The Knowledge Box (K-Box) contains rich data and knowledge of advanced materials, processes and design philosophy. It is being made freely available for Universities to use the material, re-mix and share, to build a community based on Open KE practice.

This presentation will share the philosophy, practice and speed of KE through Open Collaboration. It will also invite Universities to freely participate in the Bloodhound University Program.
Improving the employability of Physics students with the group industrial projects scheme

Jennifer King, Durham University
Paula Chadwick, Durham University
Saher Ahmed, Institute of Physics.
James McNish, Institute of Physics

Session Type: Paper Presentation
Abstract Number: 47

The Institute of Physics (IoP) is piloting a programme as part of the National HE STEM Programme that will result in students gaining employable skills. This programme, the Group Industrial Projects scheme, involves small groups of undergraduates tackling real research problems set by external clients.

Students gain skills in project management, communication skills and teamwork. They gain a better understanding of the needs of industry, including time and financial constraints, at the same time as developing as physicists. The projects are very highly rated by participating students. Participating external clients have the possibility of getting real problems solved, develop relationships within the department and also see the scheme as a recruitment and public relations exercise.

The Group Industrial Projects build on a similar scheme that has been running at the Physics Department at Durham University for over twenty years.

The (IoP) has partnered with nine physics departments to introduce group industrial projects into their undergraduate curriculum in 2011/12, with a view to the scheme becoming established as a long running component of undergraduate physics degrees. A further six departments will introduce the scheme in 2012/13.

This presentation will review the progress of the scheme, and will include the perspective from students, departments and the industrial clients.
A module in communicating mathematics

Jorj Kowszun, University of Brighton
John Taylor, University of Brighton

Session Type: Paper Presentation
Abstract Number: 52

This development was established through the National HE STEM Programme in response to the recognition that undergraduates on STEM degree courses generally have poorer communication skills than their peers studying arts and humanities. Students of STEM subjects generally do a limited amount of descriptive writing and oral presentation, even though undergraduate courses are supposed to address this issue by providing appropriate key skills components. In practice, however, the provision of training in written and oral communication tends to be inadequate.

The communicating mathematics course will run for the first time in October 2012 and the session will focus on the challenges of developing such a course. In particular, there will be discussion of the approach taken to answering key questions about audience, learning methods, electronic media and the implications for employability. The course that has been developed is specifically for students of mathematics, but is capable of adaptation for other STEM subjects.
Meeting the CPD needs of healthcare science staff

Judith Kuit, University of Sunderland

Session Type: Paper Presentation
Abstract Number: 93

The aim of the paper is to discuss the lessons learnt from collaborating with public sector employers to create more flexible learning opportunities for healthcare science technicians. It will do this by discussing project aims and outcomes and the critical success factors for effective implementation.

The aim of this project was to develop analytical sciences training provision which enabled employers to match the learning they commission in response to changes initiated by the Department of Health to modernise the careers of healthcare science staff. This project could not be achievable without the engagement of the hospital trust training managers to form an employer steering group for the project and direct the content of the learning material. Developing flexible on-line learning material is not sufficient alone to meet employee needs and an element of face-to-face teaching and support is still required. The ratio between the two elements of delivery will vary with the level of the award and the previous learning experience of the employee. Universities need to be flexible and responsive enough to be able to adapt to the sometimes conflicting demands of an employer, an employee, limited resources, externally directed curricula, university quality assurance requirements and appropriate pedagogies.
Stimulating, showcasing and transferring student-led activity

Fiona Lamb, Loughborough University
Glynis Perkin, Loughborough University
Alison Ahearn, Imperial College London

Session Type: Paper Presentation
Abstract Number: 16

Student-led, employer-focused, extra-curricular activities are endeavours that, in this paper, refer to activity in the HE STEM discipline, and are initiated, developed and sustained by students with some assistance and input from members of staff, professional bodies and employers.

The National HE STEM Programme has supported three projects related to student-led activity at Loughborough University and Imperial College London. The first project was led by Loughborough and focused on developing and implementing student-led activity at Loughborough, based on effective practice known to be well established at Imperial. The second came as a result of the strong partnership developed during the first project and the idea for a mechanism to showcase such activity, namely student-led symposia. The final project is as custodian to seven further universities and the resulting development of a student-led checklist.

This paper will briefly outline each project and the outcomes achieved, focusing on the learning journey taken by the team over the project period and the resources produced as a result.
The development of a mathematics support community

Duncan Lawson, Coventry University
Tony Croft, Loughborough University
Dagmar Waller, University of Birmingham

Session Type: Paper Presentation
Abstract Number: 65

For a variety of reasons, mathematics, although crucial to all STEM disciplines, can be a barrier to many students being successful in these disciplines. To provide support for such students, several universities have established mathematics support centres. In 2005, sigma, a collaboration between Coventry and Loughborough Universities, was designated by HEFCE as a Centre for Excellence in Teaching and Learning in University-wide Mathematics and Statistics Support. As part of the National HE STEM Programme, sigma was commissioned to develop the mathematics support community by creating a network of those involved in providing mathematics support, by funding the establishment of further centres, by developing a regional hub network to enable the local sharing of good practice and by continuing the successful annual CETL-MSOR conferences.

This paper will report on sigma’s activities within the National HE STEM Programme, including directly providing funding for the establishment of 14 new maths support centres, supporting the Wales Spoke of HE-STEM to establish a further 8 new centres in Wales and funding 6 enhancement projects in institutions that already have maths support. sigma has successfully raised the profile of mathematics support to the extent that many institutions now explicitly refer to such provision in their OFFA Access Agreements.
Identifying skill gaps of employers and Mathematics undergraduates

Jeremy Levesley, University of Leicester
Clive Rix, University of Leicester

Session Type: Paper Presentation
Abstract Number: 136

The session will describe the main new activities developed in order to deliver greater employability to the undergraduates. These include a semester long business game, an employability workshop, VBA training, and the employer-focussed project.

The key message I would like to get across is that the students need contact with employers, with projects that have some real component, and necessitate a product which an employer cares about. It is the real nature of the project which develops ownership in the student, and means that they have to improve a whole variety of skills in order to deliver their product. In general, our product was a written report, a verbal report, and a piece of well-documented working IT.

Attendees at the session will contribute ideas of their own in order to enrich the list of potential activities. We will also address the question of how to embed skills development in the curriculum, and the (hopefully I can convince you) false dichotomy of skills versus subject.

We also attempted to diagnose the skills missing in the work force. I contend that there is a tremendous lack of skill in data analysis and IT, which we can address. It means that we have to think differently about our curricula, but I can indicate how we are starting to do this at Leicester.
Keeping the lights on: Energy industry skills

Paul Lewin, University of Southampton
Justin Steele-Davies, University of Southampton

Session Type: Paper Presentation
Abstract Number: 123

The project name is derived from the current term ‘Keeping the lights on’, which sums up the power production, transmission and distribution challenges of the future. The small area addressed by this activity is the massive skills shortage that is looming within the power industry.

The aim of the project was to provide a taster of the training available at universities and interest employers/ees in undertaking more extended courses. The taster also provided valuable learning resource in its own right on key topics within the power industry. The aim of this session will be to provide an overview of the technologies used for delivery, the integration with the parallel masters programme and the feedback from students and staff within industry. Some of the key challenges and successes both within HE and industry will also be discussed.
Nurturing Talent: Widening participation with HEIs in the Somali community in Brent

Ben Littlefield, University of Southampton
David Read, University of Southampton

Session Type: Paper Presentation
Abstract Number: 114

Widening participation amongst hard to reach ethnic minorities is one of the many challenges faced by higher education institutions (HEIs) in our multicultural society. Engagement with these communities is vital to enable diversification and to give opportunities to a large number of Somali youngsters who may otherwise choose not to pursue university study. This project has been following and evaluating the Nurturing Talent initiative led by Abdinuur M Guushaa, where graduate Somali mentors have been acting as role models for students in the Brent (London) Somali community, with a view to inspiring, educating and breaking down the barriers between these students and accessing higher education.

The findings of this project will be presented with an emphasis on; the barriers encountered by Somali students, the effect of graduate mentors from the community, the change of perceptions of HE over time exhibited by students taking part in the program and recommendations and a framework for future programs with similar goals.
Using comics and drama to engage primary school children with STEM

Mark Lorch, University of Hull
Philippa Roberts

Session Type: Paper Presentation
Abstract Number: 37

We have written and produced a play in which the central characters use simple science, technology and engineering methods throughout their adventures. In a way its ‘Harry Potter’ but where you can do the spells! In so doing it is hoped that the audience will be inspired to emulate the characters. After the play the audience can take part in a workshop where they can perform the science seen in the play.

The science methods consist of techniques that can be easily performed safely in the home, such as film canister rockets (powered by vinegar and baking power), electromagnets (constructed from a nail, a coil of wire and a battery) and a pH indicator made from red cabbage. This shows children and parents how accessible science can be and how easily science experiments are.

Resources that describe the methods in a way that is easily accessible to school children accompany the play. This has been achieved by producing instructions in a comic book format hosted at www.sci-toons.co.uk. The aim of the project was to engage primary school children in STEM subjects via drama and workshops, provide them with STEM role models and to demonstrate the accessibility and excitement of STEM subjects.
The integration of green chemistry within undergraduate education aims to foster student awareness resulting in the adoption of more sustainable practice. The project we share forms part of our north-east Spoke Legacy project where the overall intention is to develop curricula to better meet the demands of the 21st Century, particularly the necessity of exploring environmentally friendly, sustainable practice. The curriculum enhancement and skills development in chemistry project that we share here builds directly on current and earlier transformational whole organisation change initiatives at the University of Bradford, and as such has relevance for chemistry students, teaching practitioners, institutions and employers.

The project is an evidence-based collaboration that pulls together the perspectives of students, teaching staff, researchers and those charged with energy monitoring in the institution. The concept of responsible science and in particular the principles of green chemistry have been used to promote discussions and activities that guide the teaching of chemistry in a responsible direction. The qualitative findings from the Bradford study includes evidence that ‘responsible science’ is a widely interpreted term, and could relate to: lab safety and taking care with dangerous chemicals; environmentally friendly behaviours in relation to disposal and conservation, and the ‘moral’ responsibility placed on chemistry to innovate new knowledge that can play an important role in mitigating against environmental change.

In sharing our project we wish to then open up the session for some discussion around the wider questions the work has raised for us. For example, given that the links between STEM and sustainable development are still nascent, how best to work with both agendas in mutually beneficial ways? In addition, it would be useful to explore how embedding good practice can be assured, including the importance of finding ‘points of connection’ between the core disciplinary requirements and expectations.
Employer networks

Angela Lupton, University of Chester

Session Type: Paper Presentation
Abstract Number: 39

The focus of the project has been to widen participation in STEM to engage those school and college students who may not have considered higher level study in STEM subjects or a career in Science related industries. In order to engage with these students normally missed by Higher Education Institutions it is important to match progress in STEM to real careers. Building industry links into targeted widening participation programmes has the potential to demonstrate real employment prospects and the opportunities for progression either through direct access into university or through apprenticeships and higher level programmes of work-based learning.

The aim was to establish a network of STEM industries to link directly with students, initially in the Cheshire and Warrington schools and colleges to match applied science skills to real employment needs.
The future for Spectroscopy in a Suitcase – Resources, good practice, sustainability and feedback

Tracy McGhie, Royal Society of Chemistry and University of Leicester

Session Type: Paper Presentation
Abstract Number: 20

Developed from a small pilot project in 2008, the Spectroscopy in a Suitcase project has grown to include all regions of the UK (due to support from the Royal Society of Chemistry and the National HE STEM Programme) and provides designated HE institutions with a means to deliver hands on outreach workshops in schools and colleges by provision of equipment and funding for delivery of the activities.

The talk will highlight the opportunity for schools and colleges to access instrumentation and relevant spectra which not only aids understanding but demonstrates the kind of practical work a university degree would include, raising aspirations, providing a glimpse into the world of HE and giving pupils an opportunity to talk about future careers with staff and university students.

Highlighted will be the need to ensure future sustainability, to this end the Royal Society of Chemistry has provided a commitment to continue to fund the project for at least two years and is actively seeking and engaging with possible new project partners to ensure longevity of the project.

Recognition of good practice will be demonstrated as over the course of the project significant feedback data has been collected and independently analysed to show the impact on student’s attitudes to studying in HE, and particularly Chemistry at University.

Also included will be details of the supporting website developed, SpectraSchool (http://www.le.ac.uk/spectraschool/). This site provides access to all the Spectroscopy in a Suitcase resources plus a library of real spectra for NMR, FTIR, UV-Vis and MS. The site has tools for overlaying, manipulating and downloading spectra, along with useful tools such as videos, posters and revision guides for both students and teachers to complement and extend the practical activities.
Jobs for the boys? Where do engineering undergraduates go?

Sean McWhinnie, Oxford Research and Policy
Jan Peters, University College London
Anthony Finkelstein, University College London

Session Type: Paper Presentation
Abstract Number: 116

Female retention in science, engineering and technology (SET) is an important issue, with economic and social justice implications. The overall retention rate of female SET graduates is far lower than that of males: the UK Resource Centre for Women in SET published figures in 2010 that 42% of male and 21% of females SET graduates secure technical jobs. This situation, which contributes to the relative lack of women in senior positions in SET professions, is sometimes described as ‘the leaky pipeline’; as scientists and engineers flow along the science career pipeline – a notional path representing training and advancement – they ‘leak out’ and are lost to science.

The presentation outlines the key findings from a survey of engineering and technology undergraduates designed to explore the career intentions of male and female undergraduates, which elicited around 4,600 responses. Work was also carried out to assess how those career aspirations compared with graduates’ initial employment or training destinations through secondary analysis of the Higher Education Statistics Agency (HESA) Destinations of Leavers from Higher Education (DLHE) data. The survey also explored how men’s and women’s career intentions differ and whether they vary through the course of undergraduate study as well as assessing how factors such as undertaking a work placement or receiving careers support affects those intentions. Additional fieldwork comprising interviews and roundtable meetings with employers and academics, and a survey of company recruitment processes, was used to tease out issues facing women seeking technical jobs.
The RSC Undergraduate Skills Record - allowing students to record employability skills throughout a chemistry degree

Amanda Middleton, Royal Society of Chemistry

Session Type: Paper Presentation
Abstract Number: 109

If students are to succeed in the increasingly competitive world of employment, skills such as the ability to communicate effectively, team working, problem solving, organisation and management are essential. There are plenty of opportunities to develop existing skills and identify skills gaps during a student’s chemistry undergraduate study, however many students are not sure how to identify the numerous opportunities presented to them every day.

The Royal Society of Chemistry, in recognition of the importance of this, has upgraded its successful continuing professional development (CPD) resource, the Undergraduate Skills Record, into a modernised, fully editable online resource, stream-lined with the RSC’s online CPD resource for members.

The Undergraduate Skills Record allows students to document the skills that they use in their course on an everyday basis; carrying out self-assessments and reflecting on and recording their abilities in important areas. This is a key tool to ensuring constant self-reflection and also is very valuable when producing a CV or applying for jobs.

This presentation details what the Undergraduate Skills Record is and how to use the new and improved online system with a particular emphasis on how to integrate this into your teaching, ensuring maximum engagement with undergraduate students.
New Physics curriculum

Lynn Moran, University of Liverpool
Helen Vaughan, University of Liverpool

Session Type: Paper Presentation
Abstract Number: 81

Developing the critical thinking and problem-solving skills of students as rapidly as possible is a key requirement in improving learning outcomes at every stage of their degree. The Department of Physics at the University of Liverpool has entirely redeveloped years 1 and 2 of the undergraduate degree with a focus on students becoming independent learners as early as possible. The aims are to better integrate the undergraduate teaching provision and to complete the Institute of Physics core curriculum in years 1 and 2, in order to focus on research led teaching and independent projects in years 3 and 4.

This new programme, entitled New Physics, starts in Welcome Week with the Undergraduate Physics Olympics and continues through the Year 1 Project (Mission to Mars) in the first week of semester one. The aim is to set the standard for collaborative achievement and introduce students to the way that physicists think. Innovative problem solving classes incorporating active learning such as peer-assessment, group learning and exemplars designed to improve these skills and enhance the quality of learning among its first-year students have been introduced.

This session will be used to outline the changes made at Liverpool, the results of evaluation undertaken to date and the plans for future development.
The Physics Outreach Group

Lynn Moran, University of Liverpool

Session Type: Paper Presentation
Abstract Number: 84

In just three years, the Liverpool Physics Outreach Group has developed and delivered workshops to over 7,000 school pupils. The Group is voluntary and non-credit bearing, meeting once per week to share good practice, develop new ideas and obtain feedback on their communications skills. Support to run projects, such as Ashfield Music Festival and Photons in the Classroom has been provided from the National HE STEM Programme and the Science and Technologies Funding Council. After some collaboration with Chemistry and Mathematics, we have put together a business case for a School of Physical Sciences Outreach Group.

Benefits to our students involved include everything from a huge increase in confidence to an improvement in their motivation to learn physics. The schools involved and the Physics Department benefit from opening the lines of communication. Evaluation indicated that the pupils in all schools visited thoroughly enjoyed the sessions and have an improved attitude toward science, and in particular, physics. The uptake of Triple (separate) Science in all schools visited has increased since our visits began. We would like to share our experience of setting up and running so many successful events on order that other departments might develop their own without having to re-invent the wheel.
Where next for widening the participation of girls and women in STEM?

Pat Morton, Sheffield Hallam University
Denise Eaton, Sheffield Hallam University
Sean McWhinnie, Oxford Research and Policy
Jan Peters, Katalytik

Session Type: Paper Presentation
Abstract Number: 91

STEM higher education in the UK has failed to make significant improvements to the intake of women students in certain key STEM subject areas. A number of projects within the National HE STEM programme have moved the agenda forward by focussing on issues around the transfer of those women who do study STEM subjects into STEM careers. But what happens now? How can we learn from past projects such as the London Engineering Project and the current outputs?

Sean McWhinnie and Jan Peters will outline new research findings from the SET to Lead project comparing the career intentions and actual employment destinations of engineering and technology undergraduates, and highlight the resources developed in the project to address the low rates of transfer of women students into relevant employment.

Pat Morton, who will chair the session, will outline some of the project work to strengthen outreach activities and lead a discussion to explore what needs to be done to stimulate sustainable change:

• The London Engineering Project was ground-breaking, but have we built on its findings?
• How can gender awareness in STEM outreach be promoted and sustained across higher education?
• Bring along your programme, your ideas and shape the discussion on effective next steps in a time of economic restraint

We urge those who recognise the importance of a diverse STEM student body and a diverse higher education workforce to attend and take part.
‘X’ Factors for Engineers

Peter Myler, University of Bolton
Brian Pederson, University of Bolton
Jim Banks, University of Bolton

Session Type: Paper Presentation
Abstract Number: 92

The main aim of the session will be to discuss the concept of missing ‘X’ factors in relation to engineering graduates (or equivalent).

The session will have a number of objectives:

1. To identify whether the concept of missing ‘X’ factors is a common phenomenon experienced by engineering graduates, employers and the wider engineering audience more generally
2. To identify what the ‘X’ factors appear to consist of
3. To discuss what can be done to address the shortage of ‘X’ factor skills and attributes
4. To determine whether the lack of ‘x’ factors really does affect ‘engineering’ outcomes
5. To attempt to ascertain the origin and nature of the driving force behind the relevant ‘X’ factors
Breaking down barriers for industrial placements: the Royal Society of Chemistry’s Industrial Placement Initiatives

Rosalind Onions, Royal Society of Chemistry
Amanda Middleton, Royal Society of Chemistry
Mario Moustras, Royal Society of Chemistry

Session Type: Paper Presentation
Abstract Number: 112

Recent research with over 500 employers across a series of sectors has identified some of the key barriers that employers perceive when considering whether to offer placements, and also the most valuable support that HEIs can provide. In response to this, the Royal Society of Chemistry organised two initiatives to facilitate the process of increased participation of employers in industrial placement schemes;

1. a guide to industrial placements, collating all relevant information regarding hosting industrial placement students into a single resource. This guide is aimed at potential host companies, providing guidance and clarifying common misconceptions about hosting industrial placement students.

2. free advertising for companies wishing to advertise placements on a dedicated placement site: http://rsc.org/iplacements.

The presentation will cover these two initiatives in more detail, explaining the precedent and key aims.
An online module in analytical chemistry has been developed for level 3 employees in the analytical services industry who have no previous experience of higher education. The course features the range of fundamental techniques likely to be met by employees in analytical chemistry and describes the basic theory and applications. The course includes three whole day sessions on site at the host project base, featuring training on the state of the art instrumentation in the Chemical Analysis Facility. The course has been trialled with employees selected from three local companies and their experiences described. The demand for courses which bridge the industry/university link leads to an increased engagement with higher education and enhances links between higher education and industry.
The qualities companies want in their graduate recruits

Kevin Parker, KKI Associates Ltd
Colin Pulham, University of Edinburgh

Session Type: Paper Presentation
Abstract Number: 22

KKI Associates have collaborated with the School of Chemistry at the University of Edinburgh to develop business skills resources for Chemists. This work was part of the National HE STEM Programme managed by the Royal Society of Chemistry. As a precursor to the development, KKI conducted a short piece of market research, interviewing key employers (including Proctor & Gamble, Syngenta, Sasol) in the chemical industry.

The talk will briefly summarise the views of the employers regarding some of the following issues:

1. How important is it for your employees to be aware of the commercial side of the company?
2. What would you regard as being the important core skills of chemistry graduate recruits?
3. How important are skills such as Innovation, Project Management, researching Chemical customers and their requirements, Finance, preparing a Feasibility study?
4. How important are transferable skills such as presentation, and report writing?
5. Should transferable skills be taught separately or integrated into other materials?
6. What type of teaching styles do you think might work well in Commercial skills training?
7. How would you measure the quality or effectiveness of any Commercial skills training?
The lack of diversity of students opting to take certain STEM courses is a cause for concern for those in education and the STEM industry alike. The reasons for this disparity are varied and can be attributed to factors such as the media, schooling or parental influences.

In order to improve HEI understanding of these factors for each of the different under-represented groups, and how HEI actions and procedures might be improved to mitigate these influences, we investigated this phenomenon through understanding how students studying a range of STEM courses at different levels of their education perceived these courses and future STEM opportunities, based on their formal and informal learning experiences. These views were compared with those of students who are currently studying undergraduate courses such as medicine and pharmacy, which are sciences where the disparity is not as significant. This research should help gain a better understanding of what different student groups studying STEM subjects find attractive about the subjects themselves and STEM careers.

The sample consisted of students studying at GCSE level, A-level and degree level. To understand what kind of approaches might entice them into considering science careers, they were asked to design posters and mind maps and to complete a short questionnaire about their background, feelings and thoughts on STEM subjects. Each group discussion was digitally recorded to get an idea of how they came up with their conclusions and overall poster/mind map design. We then conducted focus groups to get a deeper understanding with regards to their thinking on the positive messages about STEM courses and careers.
Involve, Include and Inspire! Creating the Technical Leaders of the Future

Jan Peters, Engineering, University College London
Anthony Finkelstein, Engineering, University College London

Session Type: Paper Presentation
Abstract Number: 118

Data published by the UK resource Centre for Women in STEM in 2010 provided the impetus for this work - 42% of male and 21% of female STEM undergraduates transferred into relevant technical jobs. The element of the Set to Led project to be presented is based on fieldwork with academics and employers to pinpoint the critical decision points for students’ career choices and to explore the decision making behind the numbers. A survey sought to find out more about gender differences and similarities in career intentions and destinations (this is presented elsewhere within the conference).

Our findings showed that the technical capability of female students was not doubted by employers but there were suggestions of a need to improve the confidence of women students; their self belief; provide more role models and tools to give personal insights into their own strengths to enable them to work more effectively in groups. In addition there is evidence of subtle marginalisation and of unconsciously slipping less technical team roles to women students by male peers. Alongside this was the challenge that women students do not wish to be treated differently and do not perceive barriers to their progress. From our previous research we know that interventions and materials designed to improve the learning environment for women tend also to have a positive effect on men too. A resource set has been developed and tested with students that focuses on leadership insights and attributes funded on good practice from leading employers.

This paper showcases the resources and activities drawn together to provide engineering academics with insights into leadership, delivered as a workshop ‘Leadership unplugged for engineering academics’. Working closely with industry partners the workshop provides insights into leadership and the tools, styles and models in popular use among employers in 2012. These have been developed into a series of activities that can be used alongside existing course materials or as a standalone 3 day leadership workshop.

The talk will provide insights into the activities and how they can be used, without fear, by professionals more used to teaching fluid dynamics! In addition to benefitting students those delivering the courses will also gain.
Problem-solving in undergraduate mathematics

Sue Pope, University of Manchester
Trevor Hawkes, Coventry University

Session Type: Paper Presentation
Abstract Number: 49

At the HE Mathematics Curriculum Summit at the University of Birmingham in January 2011, operated by the Maths, Stats and OR (MSOR) Network as part of the Mathematical Sciences HE Curriculum Innovation Project within the National HE STEM Programme priorities for development were identified. One priority was to collect and share good practice on problem-solving and to develop a bank of problems for use in effective problem-solving activities. As a consequence there were two National HE STEM Programme supported problem-solving in undergraduate mathematics projects.

One collected evidence from across the country on the approach to problem-solving in undergraduate mathematics course and produced a guide which incorporates case studies and developed a website and the other developed interactive starting points for problem solving that could be used on a range of technological platforms including handhelds and tablets and contributed to the other project’s guide.

This session will disseminate the projects’ outcomes and raise awareness of the support material that has been generated. The project teams will report on their outcomes. In particular:

- the extent to which courses currently incorporate problem solving, with reference to case studies from various universities
- showcasing the problem solving guide authored by the Coventry, Birmingham project and the associated web based resources
- demonstrating the LHU/NRICH interactive starting points for problem solving, hosted on the NRICH website

The implications of the projects for university mathematics courses will be discussed.
Is accreditation of in-house training a flexible and responsive model for up-skilling STEM staff?

Lucy Probyn, Northumbria University
Helen Hooper, Northumbria University

Session Type: Paper Presentation
Abstract Number: 26

This pilot project was developed to produce a framework to accredit in-house training programmes across a range of STEM employers to allow the development of higher level skills and knowledge of the workforce within the region. Northumbria University is working with regional partners, Regional Science Learning Centre (RSLC), British Engines (BE) and Siemens to enable a model to be developed that supports the businesses need for higher level STEM skills within the workplace.

The pilot has enabled cross University collaboration and has allowed University practices to be influenced with suggestions made for a new framework to accredit in-house training/education. The framework suggestions are designed to be transferable [to a wide range of STEM employers and Universities] and thus provide a sustainable mode of accrediting learning. Alongside the framework development, innovative modes of delivery and assessment have been integral to increasing the learning opportunities accessible to the workforce at Higher Education level, from levels 4-6.

Employees from partner organisations have been enrolled at the University and have engaged with credit bearing modules. The project has allowed working relationships across the University and with external partners to be further developed, allowing the University to better respond to current and future needs of external partners.
Northumbria University’s online video CV portal

Lucy Probyn, Northumbria University
Julie Edgar, Northumbria University

Session Type: Paper Presentation
Abstract Number: 27

Employer recruitment still follows a largely traditional process that has remained relatively unchanged over the years with considerable time, effort and money used to find the most suitable applicant diverting valuable resources away from core business activities. Time considerations often make skim reading of applications a necessity but key information may be missed resulting in the ideal applicant not being short-listed.

This session will discuss how Northumbria University’s Online Video CV Portal aims to provide a more efficient recruitment process that makes best use of technology to present high-quality applicants. Working in partnership with OVCV Ltd, students can create an online presence that enhances potential placement and employability prospects by allowing regional STEM employers an opportunity to search and shortlist suitable candidates. Developing an online presence should lead to higher student employment prospects as they are able to showcase their skills in a way not previously open to graduates or those competing in the traditional open market.

This project supported an existing Northumbria University National HE STEM Programme supported pilot project - “Can the employability of undergraduates be enhanced through raising curriculum content awareness and relevance in the workplace” and continued partnership work with the North East Process Industry Cluster and regional employers.
A novel pedagogy for science

Derek Raine, University of Leicester
Sarah Gretton, University of Leicester

Session Type: Paper Presentation
Abstract Number: 31

Interdisciplinary Science is a BSc (three year) or MSci (four year) degree programme developed by the Physics Innovations CETL at Leicester as part of the Integrated Sciences initiative in the Institute of Physics Stimulating Physics project and continued under the National HE STEM Programme. The core programme is taught exclusively by a form of problem-based learning with each module focused round one or more interdisciplinary problems.

This paper will discuss our experience of adapting PBL to the requirements of the degree programme. In particular we look at the provision of ‘scaffolding’ to guide students and facilitators; the impact of the use of qualified teaching fellows to deliver the facilitation sessions; and the contribution of academic research staff to the programme. We shall argue that the lessons learnt from the extended development of the programme are more widely applicable to the science education in HE.
Recorded lectures and video resources: 24/7 learning for the iPod generation

David Read, Chemistry, University of Southampton
Charles Harrison, Chemistry, University of Southampton

Session Type: Paper Presentation
Abstract Number: 113

There has been a surge in activity in the area of lecture capture in the last couple of years, with a number of universities adopting software solutions which make the process much less labour intensive and open up the technology to those without technical expertise in this area.

We have been pioneers in this field at Southampton, having initially trialled the recording and release of captured lectures in organic chemistry in 2009/10. We found that students used the recordings in a range of different ways to support their learning, although not all students necessarily use them in an effective fashion.

This presentation outlines the key findings of our evaluations, which were carried out at different stages of the project, and discusses some of the innovative new ways that video is being used at Southampton, that go beyond simple lecture capture. A key aim of the session is to discuss the barriers and enablers that have allowed us to broaden the reach of this work beyond the early adopters to become embedded in teaching in our department. The experiences of collaborators in other institutions with whom we are working as part of the Practice Transfer Adoption process will also be discussed.
The Staffordshire STEM Cluster initiative is a collaboration of local secondary schools, their STEM clubs, Staffordshire STEM centre and Staffordshire University. The project involved forming a cluster of eight local secondary schools to work with their STEM clubs to develop and undertake a programme of activities guided and co-ordinated by Staffordshire University.

Staffordshire University has offered a wide range of STEM outreach activity to schools and colleges for many years. When considering our practice and effectiveness we identified a need to provide a focus for our efforts by working closely with a cluster of schools and by linking tasks and activities to extend and enhance core science curricula. This project was undertaken in an endeavour to create sustainable links between HE, employers and the schools sector to ensure young people are well informed and enthused about the possibilities for pursuing STEM subjects at school, University and employment.

This presentation aims to deliver a brief overview of the project highlighting specific areas of good practice and innovation, problems and how we have attempted to overcome them, and the ways in which we will sustain this activity.
Higher Apprenticeships in Engineering Technology

Anthony Roberts, London South Bank University
Rao Bhamidimarri, London South Bank University

Session Type: Paper Presentation
Abstract Number: 121

This project developed a model for collaboration between higher education and small to medium sized enterprises. The scheme presented a variation of the Higher Apprenticeship model, offering employers the opportunity to work with undergraduate engineering students on short-term projects whilst training was undertaken through a university-led programme of activities. Collaboration was encouraged by managing the perceived areas of risk (namely the application process, preparatory training and managed mentoring), allowing the employer the freedom to focus on the project activities. Feedback from the participants was used as a basis for enhancements to the curriculum and the continued development of the project.
RELITE: Research-Led Innovative Teaching Experiments – reinventing first year chemistry laboratory courses

Jacquie Robson, Royal Society of Chemistry & Durham University

Session Type: Paper Presentation
Abstract Number: 34

The session will outline developments that have taken place at Durham University to redesign the first year chemistry laboratory course. The aims of this work were to incorporate more research-led and context- and inquiry-based learning, opportunities for problem-solving, group- and team-working and resources for independent study for incoming first year students. In addition, strategies were implemented to ease the transition from sixth form practical lessons to the undergraduate laboratory.

The talk will focus specifically on the reason for implementing the change at Durham, the obstacles faced, the highlights of the work and the outputs of the project including discussion of the development of new induction tasks, extension of virtual support provided via the VLE to encourage independent study, the extensive pre-lab activities, the redesigned postgraduate demonstrator training and a rethink of the assessment schedule for the laboratory course.
School Teacher Fellowship Scheme – A vital role in the school to university transition

Jacquie Robson, Royal Society of Chemistry & Durham University

Session Type: Paper Presentation
Abstract Number: 17

Jacquie Robson, the Royal Society of Chemistry School Teacher Fellow at Durham University in 2010/11, will outline the aims of the school teacher fellow scheme, and discuss the important role that it plays in helping to bridge the school to university transition.

The School Teacher Fellows are a small cohort of qualified secondary school chemistry teachers who have been placed in a University chemistry department for one year to work on projects in key HE STEM focus areas such as student transition from sixth form to higher education, tackling knowledge gaps in mathematical and practical skills, developing independent study skills, informing colleagues about recent changes to school curricula and developing Outreach activities to be delivered by University departments in schools.

The aims of Jacquie’s work were to develop strategies to develop students problem solving skills and to encourage students to undertake more independent learning on order to maximise their achievements.

This talk will focus on the objectives that Jacquie specifically set out to achieve, what obstacles she faced, how she overcame them and the outputs of her one-year placement.
Good practice and resources to address community priorities for mathematics curriculum development

Peter Rowlett, Maths, Stats and OR Network

Session Type: Paper Presentation
Abstract Number: 99

The HE Mathematics Curriculum Summit took place at the University of Birmingham in January 2011. This brought together a wide and representative cross-section of the HE mathematical sciences community – Heads of Mathematics or their representatives from 26 universities offering mathematics degrees (about half of those in England and Wales), Education representatives from the professional bodies and others – for a day of debate and discussion about the HE mathematics curriculum and to identify current sector priorities.

Following the Summit recommendations, work was supported around problem solving, assessment, graduate prospects and developing industrial problems. Curriculum content and approaches have been developed and good practice established.

This session aims to deliver an idea of the priorities identified and the work that took place to address these, and to share new good practice and curriculum resources that can be used by delegates to address these priorities in their own institutions.
Science communication and the media

Natalie Rowley, University of Birmingham
John Wilkie, University of Birmingham

Session Type: Paper Presentation
Abstract Number: 30

The findings of a recent survey of chemistry graduates published by Hanson and Overton (2010) highlighted that although the core content of Chemistry degree programmes prepares graduates well for the world of work, there is a perceived lack of preparation in a number of key employability skills.

Colleagues from the Schools of Chemistry and Biosciences at the University of Birmingham received National HE STEM and School funding to develop a new transferable skills module in Science Communication, designed to provide training in some key employability skills but incorporating a flexible format to facilitate transfer across disciplines.

This module has run for two years in the School of Chemistry as a 10 credit second year module and is delivered using a combination of cooperative, research-informed and enquiry-based learning. Students hear a number of research-based presentations which act as triggers for their enquiries. Subsequently they work together in groups to produce a 5-minute video on their chosen topic at a level appropriate for a lay audience. Alongside the video, the students produce individual written summaries for both a scientific and lay audience.

This module has recently been rolled-out more widely as part of the National HE STEM Programme Practice Transfer Scheme.
Embedding training within the Doctoral Training Centres – a case study

Wendy Sadler, Science Made Simple

Session Type: Paper Presentation
Abstract Number: 66

The EPSRC Doctoral Training Centre at the University of Bath specialises in Sustainable Chemical Technologies and takes in a cohort of students each year on a 4 year MRes/PhD course at the boundary between chemistry and chemical engineering. Since it’s inception the course has offered a unique aspect with embedded public engagement training as a compulsory and assessed aspect of the course. In addition to core modules regarding public engagement and science communication there is an annual summer school that addresses the multiple aspects of engaging the public with research.

Each year all students develop and present materials for Cheltenham Science Festival and students are offered additional modules that they can take in later years with one-to-one mentoring offered from the course leaders and associated staff. Each cohort learns and builds on the successes and experiences of the ones before and a high skills base has been established in a vibrant team of research students who will become the academics and industrialists of the future. We believe that providing such embedded training at an early stage in a research career can make a significant impact on the attitude these researchers have on public engagement throughout their subsequent careers.

In this session we will outline the content covered in the core modules and give examples of further projects that the students have worked on. We will also hear first hand from one or two of the students about what they have gained from this enrichment of their research environment.
Mathematical modelling and problem solving

Mike Savage, University of Leeds
Julian Williams, University of Manchester
Chris Dewdney, University of Portsmouth

Session Type: Paper Presentation
Abstract Number: 125

Over the past 20 years, both A-level Mathematics and Physics have undergone substantial curriculum change so that sixth formers, now entering higher education, have experienced far less problem solving than was previously the case. Through the National HE STEM Programme, 13 STEM departments across 8 universities (Leeds, Manchester, Keele, West of England, Loughborough, Swansea, Portsmouth and Bradford) are collaborating to address a problem of increasing concern that has arisen as a consequence; the need to equip students with the skills of mathematical modelling and applying mathematics to find solutions to real problems. These skills are essential for many STEM degree programmes and are highly valued by employers.

The project team will describe how problem solving based upon specific modelling skills (‘setting up a model’ and ‘modelling investigations’) is being introduced into the undergraduate curriculum so as to provide students with the skills that will equip them for both their degree programmes and future employment. It will outline the differing approaches that have been undertaken within some of the Partner institutions, and will describe an additional series of activities that have been undertaken by the Partners within this project whereby higher education STEM departments are now undertaking modelling investigations as part of their outreach activities with local schools and colleges.

The session will also present the findings from a pedagogical study undertaken to evaluate the impact of the interventions initiated. Individual and group interviews with students will reveal what they think are the benefits from this kind of work whilst examples of their work will demonstrate what can be achieved by working at the transition to university study through a collaborative approach.
A toolkit for HEIs wishing to develop work-based engineering
degrees leading to professional engineer status

Deborah Seddon, Engineering Council

Session Type: Workshop
Abstract Number: 108

In work led by the Engineering Council, a framework for flexible innovative HE
provision for engineering employees, known as Engineering Gateways
degrees, is available and degrees designed in line with this framework are
being offered at several UK universities. Higher-level learning and
development of professional competence are integrated, based around an
employee’s workplace activity, leading to up-skilling of the workforce. The
framework is applicable at Bachelors or Masters levels, and the first
Engineering Gateways MSc graduates have recently achieved CEng status.

With support from the National HE STEM Programme, a toolkit has been
produced to assist HEIs that wish to develop such provision, according to the
agreed framework but designed to meet their own operational styles, building
on their strengths and employer requirements. The toolkit draws on the
experience of the first five universities to deliver Engineering Gateways-type
degrees. It is available in hard copy and as an expanded electronic version,
with links to a range of downloadable materials.

The toolkit is presented as a road map from the initial stages of background
research and institutional context to delivery and evaluation. It draws on
research that defined the perceived challenges to adoption by HEIs interested
in the framework, as well as the critical success factors reported by existing
providers, the ‘adopter journey’ and the potential opportunities. The toolkit is
a rich source of information for HEIs wishing to develop such degrees.
‘Reigniting’ the Ashfield Music Festival project for Chemistry undergraduates: a CPBL approach to teaching transferable skills

Gan Shermer, University of Bath
Emily Maccready, University of Bath

Session Type: Paper Presentation
Abstract Number: 18

‘Reigniting’ the Ashfield Music Festival project for Chemistry Undergraduates is a project aimed at taking the model developed by the Institute of Physics in the Ashfield Music Festival and reworking it to be used by Chemistry undergraduates, supported by the National HE STEM Programme South West Spoke.

The activity tasks students with designing and running a simulated fireworks display, through which the students develop key transferable skills such as communication, teamwork, leadership and commercial awareness in a discipline specific context and requiring some basic undergraduate chemistry and physics knowledge. Opportunities to develop these skills can sometimes be lacking during STEM degree programmes but are highly prized by employers.

The resources have been developed with involvement from industry allowing us to improve the alignment between skills needs of employers of STEM graduates and the needs of the graduates themselves. In addition, the use of student peer-mentors in the activity has the additional benefit of improving the communication and employability of these students as well as those undertaking the task.

The project is readily transferable to other STEM departments as the task involves basic mechanics, numeracy and general science. This presentation will outline the trialling and evaluation of the project and the published resources will also be available.
Exploring STEM graduate careers

Tim Sibthorp, Liverpool John Moores University

Session Type: Paper Presentation
Abstract Number: 124

This project, initiated by the National HESTEM programme, explored careers advice, guidance and progression and their influence upon STEM graduate career decision making. This is one of a group of National HESTEM Programme projects researching various aspects of careers and progression in STEM. The Big Question project was based in the North West of England and involved all of the HEIs that have STEM programmes and the relevant careers services. Along with the identification of good practice, the project undertook research into current practice in STEM graduate careers advice. Interviews were held with STEM graduates, careers advisors and employers across the region.

Key factors that typify the experiences of STEM graduates as they enter employment have been identified along with the trends in provision. The views of employers have been codified to create comprehensive advice on how employers might work to improve the recruitment and retaining of STEM graduates. The outcomes of this project provide practical advice and guidance for the future provision of careers advice and guidance to STEM graduates as they progress into employment.
Superhighways into the curriculum and employability: A three-way collaboration

Serengul Smith, Middlesex University
Paula Bernaschina, Middlesex University
Adam Edwards, Middlesex University
Vanessa Hill, Middlesex University

Session Type: Paper Presentation
Abstract Number: 63

For a variety of reasons science and engineering students tend not to be ‘readers’ or ‘writers’. They often arrive at university not realising that they will need sound information literacy skills and the ability to filter and evaluate the most appropriate sources to do research nor that they are expected to read and write reports and essays at academic level. Intertwined in these activities is the necessity to think critically. The lack of criticality is most apparent when students produce written work, which is most often simply a summary of what they have read or done. Although the act of writing is often considered to be a solitary one, in reality this is not the case, especially when the writing takes place in an academic environment.

At Middlesex University we have formed an intra-university team (The School of Engineering and Information Sciences, the Learner Development Unit and Learning Resources) to target the development of academic and information literacy as well as graduate employability.

This work discusses and critically analyses progress so far with the integration of various skill sets into the wider employability skills framework devised by this team. This has included work planning the detailed curricula to be followed at each level and coordinating this with academic writing, information literacy and other skills.
Threshold concepts were developed from a UK national project, which focused on student learning in different disciplinary areas. Meyer and Land (2005) realised that certain concepts central to the discipline would open up required systems and “ways of thinking” but yet were troublesome for students. Meyer and Land (2006) suggest that the learners may be left in a state of liminality (Latin ‘limen’- a threshold). Liminality is a suspended state in which ‘understanding’ falsely approximates to a kind of mimicry. Identifying the threshold concepts can help with curriculum design by focusing students attention on the most troublesome and yet transformatory areas. Understanding why these concepts are threshold can assist with designing teaching methods and assessment approaches.

In this paper, we will present the emerging methodologies developed by the team demonstrating the way that they collected data using interviews, focus groups and workshops and how they analysed data using concept mapping tools. We will also focus on the materials concepts discovered during the research within each institution noting areas of overlap and considering differences and the potential reasons for these. We will particularly invite debate, discussion and feedback by members of the materials education research community at this conference.
Using sectoral business clusters to stimulate employer engagement and academic programme development in UHOVI to meet learner needs and local employment opportunities

Richard Staniforth, UHOVI
Francis Cowe, UHOVI

Session Type: Paper Presentation
Abstract Number: 119

UHOVI STEM employer engagement-workforce up-skill project focuses on level 3/4+ requirements across a spectrum of STEM employers across the SE Wales valleys. UHOVI works locally with HE providers, students, businesses and potential workforce across challenging post-industrial areas: Merthyr Tydfil; RCT; Blaenau Gwent; Caerphilly; and, Torfaen. These are designated as disadvantaged areas with some of the lowest levels of educational attainment and skilled employment opportunities across Europe.

In order to deliver meaningful outcomes the project is developing a critical mass of learners matched to realistic employment opportunities, at a range of levels, across a diverse spectrum of sectoral activity. Existing STEM specific provision from the UoG and UWN has been identified to service baseline delivery assisted by European funded projects.

Establishing high level pan-sector employer needs to develop a workforce pool is key to long term strategic success. A critical mass of learners has the potential to drive collaboration with business and ensure academic engagement. This engenders development opportunities for bespoke accredited learning materials.

UHOVI’s STEM research strategy involves approaching sector-specific companies, e.g. pharmaceutical or automotive industry, establishing ‘sticky cluster’ common interest groups. These include UHOVI, company and government representatives to maximise the potential for effective development of learning opportunities.
Embedding industry-lead touch points within HE engineering programmes – evaluation of different approaches

Jill Stewart, University of Lincoln
Michael Gallimore, University of Lincoln

Session Type: Paper Presentation
Abstract Number: 132

The Lincoln School of Engineering was founded in 2010 in collaboration with Siemens Turbomachinery Ltd. The close relationship between the two organisations enabled opportunities for learning to be extended beyond the classroom and into the workplace via a series of industry-lead ‘touch-points’. The purpose of the ‘Touch-Points’ project was to identify the elements within a mechanical engineering degree programme that could be delivered by industry in order to secure progress towards the School of Engineering’s overarching goal of delivering industry ready graduates. These touch-points go beyond more typical practice of industry-sponsored projects, as they extend throughout the entire degree syllabus.

In 2011, the School of Engineering won the Lord Stafford Award for Open Collaboration with Siemens, and was highly commended by the IET in the ‘Team’ category of their annual awards. The touch-point programme formed the basis of both entries.

In Lincoln, Siemens has found a university able to engage with the company in a way that meets its needs, and the School is cited within Siemens global business as “the model for industry-university engagement”. The Touch-points project has been extended to involve other companies, and this paper will report on the process and practice of the touch-points projects.
Enhancing the second year experience for undergraduate mathematicians

Sharon Strawbridge, University of Exeter

Session Type: Paper Presentation
Abstract Number: 10

There is a big transition in conceptual mathematical thinking required of students as they move from first year mathematics to second year. Students need to develop mathematical fluency to be able to develop the mathematical tools to access the mathematics they encounter in the second year such as analysis, proof and PDEs etc. It has been noted by many mathematics educators that students come into mathematics degrees inspired and eager to learn; when they start to approach unfamiliar problems they can hit obstacles that can very often demotivate them. Very often the right additional resources can make a huge difference to the students understanding and enjoyment they gain when seeing new and exciting maths.

I have lead a National HE STEM Programme project this year, which has followed on from a project undertaken by Professor Tony Croft at Loughborough University, where the abilities and experience of students who have recently undertaken the second year modules can be harnessed to create resources for their fellow students.

I want to discuss the project we have undertaken at Exeter, where second and third year student Interns have worked with module leads this summer to produce targeted additional resources to support the second year teaching. I want to look at the resources themselves and the way the project has developed our Interns both mathematically and in many other ways, finally, I want to discuss the legacy of this project both in terms of resources and within Mathematics in general in Exeter.
The transition to university mathematics across the STEM disciplines by students who have come from more unconventional routes can often be difficult. These students can encounter barriers to learning that their fellow students who have arrived via the A level route do not.

Mature students and those coming from a more vocational background often lack both confidence and breath of previous experience in higher mathematics, this can severely hinder their attainment across their degree, especially in that crucial first year. For example, Access courses are often very broad and do not give enough reinforcement of mathematical skills. I will discuss the need for adequate preparation before starting at University and the importance of building confidence in students.

This year, I have lead a National HESTEM Programme Practice Transfer project which follows on from an excellent project run at the University of Nottingham working with engineering students. The Exeter project has focused help directly at students across the College of Engineering, Maths and Physical Sciences. I have developed and supported a team of six postgraduate tutors, who have been delivering small group and one-to-one support. They have been teaching and supporting a range of first year students who have come into HE via Access, BTEC and other more unconventional routes, with the aim of improving performance and engagement across the programmes they are studying by removing some of the barriers to achievement by bring up the level of mathematical skills in this cohort.

The group of tutors who are working on this project have developed a range of skills and approaches to teaching and have benefitted from the input from our Educational Enhancement team who have helped to run training sessions and discussion meetings. I will discuss what support is needed to develop postgraduates in this role.
Building the Nuclear Island: Enhancing hands-on learning and employability skills for nuclear new build

Caroline Sudworth, Cogent Sector Skills Council
Alison Ahearn, Imperial College London

Session Type: Paper Presentation
Abstract Number: 55

Building the Nuclear Island aims to encourage undergraduates to understand and consider careers in the UK nuclear new build programme. It is a UK wide collaboration between academia and industry, facilitated by Imperial College London, Cogent, ECITB, Construction Skills, the Royal Academy of Engineering and Constructionarium Ltd.

Consultation and collaboration between industry, academia and stakeholders resulted in existing best practice being transferred to meet the specific requirements for the future nuclear new build industry.

The programme piloted the design and construction of a scaled down reactor core and containment building: this was undertaken by Imperial College London in June 2011 with industry observers on site. Subsequent additional project evaluation has been used to improve the design and curriculum for wider university uptake from 2012.

Key learning experiences from this project include handling political and industry issues, enforcing industry quality standards versus the limitations of a five-day on site experience and, embedding employability and career awareness within the undergraduate cohort. The paper considers how this is assisted by the project.

Evaluation and experiences will be presented demonstrating clear alignment of benefits to collaborative working and required learning outcomes. An outline of future implementation for wider university uptake is also proposed.
Facilitating enhanced knowledge and progression for Engineering and Science students through a proactive mathematics support intervention

Ria Symonds, University of Nottingham
Stephen Hibberd, University of Nottingham
Tom Cross, University of Nottingham

Session Type: Paper Presentation
Abstract Number: 41

Some students entering undergraduate courses in Engineering and Science have difficulties in making the transition to university mathematics and in coping with the required demands in this discipline. A key pedagogic requirement is for them to receive initial and ongoing student-led support to enable them to progress rather than fall away and be identified only on failure.

To help develop sustainable and effective measures for identified students to overcome initial academic deficiencies in mathematics on transition and to help build student confidence and gain greater skills from core learning during the first year, a pro-active intervention provision has been developed and embedded at Nottingham University. The new provision provides structured tutorial sessions, linked directly to core maths topics, for nominated students. These students are also given access to key reinforcement materials via a Virtual Learning Environment. This initiative, supported by the National HE STEM programme, started in September 2010 with Engineering students. The delivery is based on group-tutorials provided by carefully chosen, trained and managed postgraduate student teachers (PSTs) together with selected and collated on-line resource materials. Ongoing project development through the National HE STEM Programme Practice Transfer Initiative is further increasing engagement through Science students and increased personal development and sustainability with PSTs.

This paper will provide an overview of the development through the first year of implementation and consolidation through the second year of this now sustainable provision, together with longitudinal outcomes.
No internet? No problem - Delivering distance learning to offline users

Richard Thain, Plymouth University
Jonathan Scott, Plymouth University

Session Type: Paper Presentation
Abstract Number: 69

How do you get your workforce to engage with Higher Education effectively when they are deployed on ships or on oil rigs for extended periods of time? Limited internet access, no access to telephones, and irregular working patterns all create significant problems for learners wishing to enhance their qualifications.

These potential students are mainly working full time and often offshore in faraway locations and, therefore, residential study is not an option. There is currently no part time, or distance learning educational provision which meets the needs of employers or employees in this sector. We ran a survey (n=356) to find out what the major limiting factors were to potential students while they were working at sea preventing them from engaging with Higher Education.

A review of the TLP (Total Learning Package) which has been developed for this project will be presented, together with a discussion on the use by remote learners of narrated lectures, formative assessment, supplementary reading materials and study guides.

This paper will be of use to those who wish to use the Hydrographic Academy as a model for distance e-learning provision, and apply it to other relevant areas where employer collaboration and workforce development are important.
Meeting the needs of employers and employees in challenging times: challenges, opportunities and impacts

Richard Thomas, Swansea Metropolitan University
Kelvin Lake, Swansea Metropolitan University
Michael Bowen, Swansea Metropolitan University

Session Type: Paper Presentation
Abstract Number: 117

This paper presents a case study based on the experience of the School of Logistics & Manufacturing Engineering at Swansea Metropolitan University. Part-time engineering education is a well-established tradition in the UK and has a good track record of enabling engineers who, for a variety of reasons, did not progress to studying engineering at university directly from school, but took up a career in industry and later in their careers returned to study on a part-time basis. However, reductions in workforces due to the need to reduce costs or the replacement of personnel by automation, or changes in working practices have made it more difficult for many companies to release staff for traditional day-release study.

This paper documents the approach developed at Swansea Metropolitan University, reviews the challenges facing employees and employers, analyses student performance in comparison to full-time students on equivalent courses and, based on structured interviews with students, graduates and employers, attempts to evaluate the impact of this approach on the careers of graduates from the programme and their employing organizations. The challenges of delivery and the impact of this provision on the university department itself and its staff will also be discussed.
In this paper we describe the research project to investigate interactions between small to medium-sized enterprises (SMEs) and higher education institutions (HEIs) in STEM subjects.

Four student researchers and an IATL project research officer obtained views from students, academics and SMEs, through surveys and interviews. This included an online survey completed by 722 STEM students from the University of Warwick, which represented a sample size of 13.7 per cent.

Research findings and recommendations were triangulated with intermediaries such as local councils to ensure they were robust and practical.

The key themes that emerged from the research were:

- The careers industry
- Do SMEs understand what graduates want and what they can offer?
- What do students know about SMEs?
- The potential for increasing interactions

Six recommendations that came from the research were:

1. A single internet site/portal is required for SMEs to distribute opportunities around HEIs
2. Students should set up networking events for SMEs
3. Where applicable, SMEs should advertise the potential for career progression in their graduate positions
4. Universities should ensure that information about company-funded STEM research is available to students
5. University STEM departments should encourage more guest lectures
6. HEIs to further promote student and graduate employment in SMEs
Educating tomorrow’s scientists: Preparing graduates for work

Adrian Toland, Manchester Metropolitan University
Paul Hooper, Manchester Metropolitan University

Session Type: Paper Presentation
Abstract Number: 44

This paper presents on an ongoing dialogue in England and Wales regarding the readiness of STEM (Science, Technology, Engineering and Maths) graduates for the world of work. Employers often identify generic employability skills as a non-discipline specific priority for business when recruiting graduates and highlight that STEM graduates in particular are not sufficiently demonstrating these at recruitment. In addition, there is wider recognition of the importance of ‘T-shaped’ skills sets, where the depth of disciplinary skill is enhanced by the ability to apply knowledge across various work-based situations.

The paper outlines a range of interventions across Higher Education that aim to enhance the employability of graduates. In addition, this paper raises the question as to whether future Higher Education curriculum development should focus on further graduate skills development or on better articulation of existing graduate skills among the graduate body. Is the answer, at least in part, related to how the language of employability is used by employers, interpreted by academia, and understood by graduates?
Developing and trialling problem based learning resources for undergraduate chemistry students

Dylan Williams, University of Leicester
Kevin Parker, KKI Associates Ltd

Session Type: Paper Presentation
Abstract Number: 23

This project is based on the development of a new problem based learning (PBL) case study and the evaluation of its effectiveness in a pilot phase implementation. This case study forms part of a series of new PBL and context based learning (CBL) resources produced by a number of institutions in association with the Royal Society of Chemistry.

This primary aim of this project was to develop a new PBL case-study (of equivalent value to a 5 credit module) based on the key area of Energy together with an accompanying tutor guide both of which would be made freely available to UK HE institutions as open educational resources (OERs). This presentation will discuss the practicalities of developing this resource including strategies for collaborating with other authors and advice on how to ensure authenticity of case studies as well as a summary of the key findings from the pilot project which has seen the resource adopted by three UK Universities.

The presentation will conclude with a brief discussion of the practical aspects of how these resources may be integrated into existing degree programmes.
Developing web-based training resources to support effective student transitions in to science-based industries

Helen Williams, University of Reading

Session Type: Paper Presentation
Abstract Number: 7

Through this National HE STEM Programme project, the Biopharma Skills Consortium (comprising the Universities of Reading, Surrey, Kent, Portsmouth, Brighton, the Open University and the Royal Veterinary College) responds to a recognised industry skills gap: the experience gap. The project has drawn on learning from two ECIF funded projects, the Reading-Surrey Biopharma Skills Internship project and the Royal Veterinary College Overcome Recession: Bioscience Investment in Skills (ORBIS) project, and capitalises on the University of Reading and the Open University’s experience in developing online career learning materials.

The project has collated and developed resources from Consortium institutions and beyond to support students moving in to biopharma to make a more productive transition in to placements and employment by encouraging a greater understanding of the structure of the industry, the roles and functions within it and the demands of a commercial rather than academic scientific environment. This session will:

- Introduce a set of freely available online training resources for students and staff to support preparation for placements and employment in science-based industries
- Highlight the benefits of collaborative working across HEIs to respond to an identified STEM industry need
- Demonstrate effective use of varied online media in STEM teaching and learning
Mathematics teacher fellow and student shadowing project

Robert Wilson, Cardiff University
Peredur Powell

Session Type: Paper Presentation
Abstract Number: 102

Despite an increase in the number of students taking and achieving good grades in A-level mathematics, there remains scepticism in higher education whether the students are sufficiently prepared for the challenge of university mathematics. Numerous mechanisms are already in place to assist students making the transition but how much is actually known about student experiences prior to attending university? Furthermore, how much do schools/colleges know about the current university provision of mathematics?

As part of a National HE STEM Programme Wales project, a teacher from a local comprehensive school was seconded for a full semester at Cardiff School of Mathematics to review the experiences of students within their first year, and to make comparisons between approaches to teaching and learning at A-level and University. This paper will report on the findings of the teacher fellow project, and include an overview of the ‘top tips’ to assist universities in developing its first year provision, as well as providing key points to inform A-level teachers about the expectations and rigours of university mathematics.

Further results will also be presented on the feedback obtained by postgraduate students, who complemented the Teacher Fellow project by visiting local Schools to discuss their own experiences and garner student expectations of university mathematics.
Activity-led learning for engagement with engineering professional skills and attributes

Sarah Wilson-Medhurst, Coventry University
Paul Green, Coventry University

Session Type: Paper Presentation
Abstract Number: 14

This presentation summarises the findings from a research project designed to illuminate the student experience of activity led learning for engineering professional skills and attribute development. The project sought to explore the impact of Activity Led Learning innovations on student engagement with professional skills and attribute development, building on other and earlier work, that suggests ‘active learning’ approaches have a beneficial impact on students’ development and engagement with ‘professional’ aspects of their development including team-working, communication and self confidence. In particular it will highlight:

- The evidence, drawn from the student experience, of the impact of activity led learning on student engagement with specific professional skills and attributes, as well as their general preparedness for industry

- Findings that can extend the STEM sector’s understanding of how to use ‘active’ or activity led learning experiences for the promotion of professional skills and attribute development.
Abstracts: Workshops & Symposia
(Presented Alphabetically by Lead Author)
Developing enterprising STEM undergraduates workshop

Stuart Abbott, Cardiff University
Neil Coles, Cardiff University
Jeremy Hall, Cardiff University

Session Type: Workshop
Abstract Number: 78

The National HE STEM Programme and Cardiff University ‘Developing Enterprising STEM Undergraduates’ project enabled the piloting of a curricula-embedded multidisciplinary module entitled ‘Commercialising Innovation’. The module was designed and delivered with a view to engendering enterprising, commercially aware and therefore more employable graduates. Central to such awareness is an understanding of the processes and considerations involved in taking an innovative idea, product or service from concept to commercial marketplace. In order to contextualise this understanding from the perspective of multiple disciplines the module framework was authored with a flexible emphasis on core aspects of the commercialisation process, with the intention of subsequent adaptation and alignment to suit the requirements and relevancies of the various STEM disciplines as appropriate.

This workshop will provide an opportunity to apply, develop and discuss the project outputs and associated findings in relation to STEM teaching and learning. Participants will engage in the process of ‘populating’ the module framework template in discipline specific groups. In doing so they will generate preliminary module outlines relevant to their own subject teaching, develop pertinent networks of shared practice and resources and contribute to Cardiff University’s ongoing developmental understanding of the core ‘Commercialising Innovation’ module content and its application within the STEM disciplines.
Project evaluation of a pragmatic and realistic nature (Pawson and Tilley 1997) has been a distinct feature of the National HE STEM Programme and considerable thought and resource has gone into how the Programme has supported colleagues through a series of Evaluation Workshops. A solid grounding in the various methodological approaches, followed by exploring what’s in the ‘toolkit’ i.e. the range of data capture and analysis options that are available, as well as the necessity of thinking about ethics and quality control have formed the main part of these workshops.

In this workshop the authors reflect on the fostering of evaluative research skills in National HE STEM Programme project leads during the latter half of the Programme. Real world or realistic evaluation starts with the premise that evaluative research will be anchored in actual situations and therefore evaluation outputs will be well suited to informing developments in policy and practice. A sound grasp of methodology i.e. overall design or approach, coupled with an appreciation of what data collection methods are on offer is a good starting point for any would-be evaluator, and the Programme has sought to provide a grounding in these with a series of National HE STEM Programme Evaluation Workshops. However the authors argue that the mandate with which practitioners have worked has included a third, more esoteric aspect: in asking projects to engage in evaluative research activity the Programme has brought social science very much to the fore in the context of the predominantly positivistic disciplines that comprise STEM. This has led to very rich discussion and reflection, not least those concerned with the philosophy of social science, and some of the main themes and implications for organisations that emerged are actively explored in this participatory workshop.
Join the Science Circuit (hands-on activity - taking part essential)

Debra Croft, Aberystwyth University
Roger Morel, Aberystwyth University

Session Type: Workshop
Abstract Number: 82

This session will consist of a short introductory talk about the Science Van project and outline some typical activities, including the necessity of depth and breadth in an activity, as well as variety and flexibility in a suite of activities. We will use a forensic science example to demonstrate ‘depth and breadth’ and then consider variety and flexibility in the context of an unknown audience/open day setting, including the role of quizzes and competitions. A ‘mini-carousel’ of hands on activities from pilots run as part of the UK/Wales spoke National HE STEM Programme will then be available to the group to use as discussion for strengths, weaknesses, improvements and adaptations.

This workshop is designed to share some of our experiences and to disseminate learning points, as well as to engage other STEM professionals and gain new ideas to feed back into the project, which has been sustained within the Institution.
Embedding writing development in STEM disciplines: from strategy to practice

Trevor Day, University of Bath

Session Type: Symposium
Abstract Number: 24

Many employers of STEM graduates expect their new employees to have strong writing abilities, which can be turned to writing for a wide range of audiences and purposes. Evidence from the National HE STEM project ‘Developing Writing in STEM Disciplines’ (http://go.bath.ac.uk/stemwriting) suggests that both students and potential employers consider that universities should play a major role in developing undergraduates’ writing abilities and in extending their writing repertoire. That being the case, how might STEM students best develop such capabilities on undergraduate programmes? Members of the original project, and the subsequently formed National HE STEM supported special interest group ‘Writing and Communicating in STEM Disciplines’ (http://go.bath.ac.uk/stemwritingandcommunicatingsg), will consider key writing development challenges and suggest appropriate responses. They will propose how developing writing for academic purposes and for wider employability can be combined. They will highlight how both bottom-up and top-down initiatives for embedding writing development can be successful. And they will offer examples of successful teaching and learning practice, from broad- to fine-scale, which empower STEM students to be effective writers. Attendees will be encouraged to participate, by asking and answering questions and sharing their experiences.
Discover! An out of school Science Club for girls

Claire Evans, Glyndŵr University
Dawn Colyer, Glyndŵr University

Session Type: Workshop
Abstract Number: 111

Although the news headlines tell us girls are outperforming boys at STEM subject, fewer girls go on to study theses subjects at a higher level. The Discover! club was set up with the aim of raising awareness of STEM careers available to girls. The club was aimed at year 9 students, with the intention of getting them interested in STEM subjects before they make those important GCSE choices.

The session will begin with an introduction to the Discover! Club programme and how the various partnerships worked together to plan the session themes. The partnerships included; Glyndŵr University, Techniquest Glyndŵr, Careers Wales and Toyota. This will include a description of the project as a National HE STEM outreach programme to enhance students aspirations for further study and careers available to them in their local area. The session will move onto allowing participants to try out a carousel of activities that were available to the club members and ask questions of the presenters. These can include the reasons for choosing the activities and the links with the University courses available. After the hands on part of the workshop participants will see the results of the workshop from the club members and their parents feedback. The impact on Glyndwr University and the future of this project will also be discussed at this time. The session will conclude with participants having the opportunity to discuss the various elements of the Discover! club and the impact they think it could have in their institution.
Engineering Careers – enhancing HEI academics’ work with school teachers in supporting their knowledge of engineering careers and qualifications

Janice Griffiths, University of Southampton

Session Type: Workshop
Abstract Number: 68

Broadening teachers’ understanding of modern engineering, careers in the energy sector and the scale of the investment required within the sector in the future is vital if the UK is to develop the workforce to compete within the global marketplace. Equally important is that school pupils are able to access advice that will enable them to make informed choices regarding engineering careers. A newly developed Continuing Professional Development session was delivered to 55 science and technology teachers to enhance their knowledge and confidence with regards to offering advice and guidance to pupils and fellow colleagues. The resource, facilitated with input from HEI academics, Science Learning Centre staff and National Grid engineers, has been shown to be effective in enhancing teachers’ knowledge of careers in engineering and providing advice and communication with students. The impact has been that lesson plans and schemes of works within delegates’ schools have been enriched to include engineering careers specific advice. Pupils at these schools will now be introduced to the variety of options available within engineering careers. Teachers are now confident to offer specific advice to underrepresented groups such as females and pupils from BME communities to widen participation within engineering.

This session will explain the rationale for the project, highlight examples of good practice in delivering careers training and will report on plans to disseminate further through the national network of Science Learning Centres.
Virtual Laboratories – How do you use yours?

Paul Hatherly, The Open University
Nicolas Braithwaite, The Open University
Chris Barrett, The Open University
Tim Gledhill, University of Hertfordshire

Session Type: Workshop
Abstract Number: 46

This workshop aims to explore and inspire aspects of virtual laboratories in the light of a National HE STEM Programme project carried out by the authors, building on previous developments and experiences, and the requirements and experiences of participants.

The variety of methods for creating virtual laboratories is vast, ranging from animations and simulations, through real data captured in interactive screen experiments to remotely controlled real experiments. The workshop will therefore be of interest to participants wishing to share their experiences and practice, and to those wishing to implement virtual laboratories for their own institutions or disciplines.

With the topic placed in the context of the authors’ experiences, participants will engage in cross-disciplinary and cross-institution groups to explore virtual laboratory use, development and pedagogical research. The workshop will conclude with groups reporting their discussions and findings, with material collated for dissemination.

As most aspects of virtual laboratories are interactive, participants are encouraged to bring their own laptops/tablets or similar devices.
Transition and retention: A panel discussion

Kamel Hawwash, University of Birmingham

Session Type: Symposium
Abstract Number: 131

While increasing the supply of students to STEM Higher Education is important, ensuring that they experience a smooth transition to university study and that as many as possible complete their studies successfully is of equal importance. There is a wealth of initiatives in this area that have reported on effective practice to achieve this. The National HE STEM Programme commissioned a suite of guides on transition and retention which consolidate much of this effective practice and supplement it with a student perspective. The work is presented 8 guides covering a range of areas. The purpose of this panel discussion is to launch the guides and to discuss issues raised from the participants.
Keeping it going: Is enthusiasm enough?

Jo Heaton-Marriott, University of Central Lancashire
Ally Caldecote, University of Warwick

Session Type: Workshop
Abstract Number: 75

We’ve all been there; you come up with a fantastic idea for an outreach project, people are supportive, the funding is awarded and the project takes off. But then what? So many great initiatives lose momentum as key personnel move on, institutional priorities change and funding comes to an end. This workshop will explore participants’ experiences of these challenges and using a world café style format, generate ideas, solutions and best practice for ensuring sustainability of projects.
Sensing our world

Margaret Low, University of Warwick

Session Type: Workshop
Abstract Number: 43

This workshop aims to give participants an understanding of how hardware and software interact in modern devices, like mobile phones. Participants will have the opportunity to use the Scratch Sensor Board, and develop software to respond to real world events. The workshop will also look at how to build and calibrate some simple ‘home made’ sensors to enhance the existing capabilities of the sensor board.

This is one of the outreach workshops developed through the Encouraging Young Engineers (EYE) project, and delivered by student volunteers to local school children. These activities take advantage of young peoples’ interest in and fascination with aspects of technology. Highly sophisticated devices, which are designed to be easy to manipulate without an understanding of how they work are embedded in our society. As a consequence young people from all groups and backgrounds are immersed in this technology. This immersion provides an opening via which we can encourage young people to reflect on how such devices operate and in what possible ways they could develop in the future. By its nature these activities cross science and engineering boundaries.

Workshop participants will require a laptop with Scratch and the sensor board driver installed. Details are available here: http://go.warwick.ac.uk/scratchsensors
Business skills resources for Chemistry for higher education institutions

Amanda Middleton, Royal Society of Chemistry
Samantha Pugh, University of Leeds
Kevin Parker, KKI Associates
Paul Taylor, University of Warwick
Trevor Farren, University of Nottingham
Neil Williams, Kingston University

Session Type: Workshop
Abstract Number: 90

The lack of business skills and commercial awareness in STEM graduates has repeatedly been cited by industry in recent years. Traditional ‘bolt-on’ teaching of business skills by business schools to chemistry students has been unsuccessful and is in decline. In response to this, the RSC has commissioned 5 UK HEIs (Leeds, Warwick, York, Edinburgh (with KKI Associates) and Nottingham) to develop resources teaching subject-contextualised and relevant business skills for chemists for full integration into the chemistry curriculum. Some resources will also provide the opportunity for self-study through online activities.

This workshop will allow interested delegates to sample some of the interactive activities as detailed in these resources, and understand the applicability of business in the chemical sciences with a hands-on approach.
Talking about careers: The language used by and with young people to talk about life learning and work

Nicki Moore, University of Derby

Session Type: Workshop
Abstract Number: 86

This workshop will explore the issues raised through research conducted by the International Centre for Guidance Studies at the University of Derby and supported by the National HE STEM Programme. The research (Moore and Hooley 2012: http://www.derby.ac.uk/icegs/icegs-news-archive/search-icegs-news-archive/talking-about-careers) set out to understand how young people conceptualise generic and STEM career vocabulary in order to help those tasked with supporting their career decision making to do so in a way which was both engaging and effective. The research found that there is considerable confusion about a range of career vocabulary both amongst young people themselves and between young people and the adults who seek to influence and inform their careers.

The workshop will pose interesting questions of delegates:

- How do they conceptualise generic careers terms?
- What are alternative views of these concepts?
- What are the implications for the discussions which they may have with young people and learners who are considering STEM careers?

By the end of the session delegates will have:

- Developed an understanding of the complexities and issues associated with defining a range of career and STEM career concepts
- Identified the implications of making assumptions about young people’s understanding of career terminology
- Explored strategies to help young people to develop ways of understanding career terms which are helpful in supporting helpful and effective career conversations
STEM careers awareness - a new postgraduate module

Pat Morton, Sheffield Hallam University
Claire Nix, Babcock
Alison Braddock, Swansea University

Session Type: Workshop
Abstract Number: 94

This project has designed, developed and run a postgraduate pilot module to a group of teachers and careers advisers in Wales and South West England based on new online resources as part of the STEM Subject Choice and Careers Project. The course was designed to promote STEM awareness and improve the awareness of those advising and teaching of young people so that they can give informed advice and guidance as well as information. The course has taken the agenda of STEM careers awareness forward in a time of uncertainty. The session will provide a taster of the activities and resources drawn on within the module and will share some of the materials developed by students to improve their own practice.
Helping STEM students become employable: Strategies and resources for students of Maths, Science & Technology

Karen Moss, Nottingham Trent University
James Hind, Nottingham Trent University

Session Type: Symposium
Abstract Number: 120

There is clear evidence that employers of STEM graduates require a different profile of skills from their future employees to meet the changing demands of the market place; with high levels of professional STEM skills plus well-developed personal and transferable skills. However employers also feel that STEM graduates are poor at evidencing practical and professional skills hence limiting their employability.

This session tells you about the approaches we developed to improve the STEM students’ abilities to articulate their practical/professional skills, enhancing their employability. Our two projects involve students from Maths, Chemistry, Physics, Forensic Science & Computing. Resources developed include:

- The graduate ‘survival guide’ created for maths graduates making the transition into employment
- A process of employer engagement in the design and running of an industrially relevant curriculum with skills-based assessments and the introduction of problem-based learning materials – these increase students’ engagement with their learning and foster the skills and qualities industry seeks
- Assessments which focus on both practical/professional competencies and transferable skills in a robust manner
- A report on our work with employers on the needs of industry and the changes HE can make to accommodate these

Our session will give you ideas, examples and models that you can use.
Context and Problem Based Learning resources for higher education Chemistry departments

Rosalind Onions, Royal Society of Chemistry
Amanda Middleton, Royal Society of Chemistry
Dylan P. Williams, University of Leicester
Claire McDonnell, Dublin Institute of Technology
Michael Seery, Dublin Institute of Technology

Session Type: Workshop
Abstract Number: 88

Context/Problem Based Learning (C/PBL) is a teaching methodology that aims to increase students’ engagement with a subject by delivering courses which are based upon real-life applications of the principles, techniques and experiments students encounter in their undergraduate courses. These real world contexts are presented in the form of problem scenarios which are ill-defined and have a number of satisfactory solutions. Learners work collaboratively to problem solve and acquire new knowledge and to then present the outcomes or product. This approach provides the opportunity to develop valuable transferable skills such as communication, team working and problem solving. Students are encouraged to take control of their learning and real world examples are used as an effective means to promote real learning.

The Royal Society of Chemistry has developed a suite of 10 new C/PBL resources highlighting the major role of the chemical sciences in addressing global challenges outlined in the RSC’s roadmap, Chemistry for Tomorrow’s World, which were then trialled by 20 HEI’s to ensure that these resources are as easily transferable as possible. They are accessible to everyone via the RSC Learn Chemistry portal.

This workshop will allow participants to become more informed about the C/PBL approach and to consider how best to implement these activities in their institutions.
Assessing student learning from public engagement

David Owen, National Co-ordinating Centre for Public Engagement

Session Type: Symposium
Abstract Number: 115

Embedding Public Engagement (PE) in the STEM curriculum can enrich student learning, develop employability skills, and provide a foundation for civic and social growth. Furthermore PE can address the needs of communities; help to develop effective learning partnerships between students and traditionally underrepresented groups of learners; and increase the university’s relevance to, and impact on, civil society.

Many courses recognise the value of applying knowledge as means to generating student learning about their subject. However, there are a number of core attributes which if developed may help students apply their knowledge more effectively. These could include project management skills, flexibility, the skills to reflect, confidence, empathy and openness to learning from different people. Assessing student learning in relation to these attributes is one way of aligning support that can help produce graduates who are ready for their preferred futures.

This symposium aims to explore the value of embedding public engagement in the taught curriculum, and look at how student learning from public engagement can be assessed as part of a taught programme.
Creating capability to inspire STEM engagement through support in the primary classroom

Gayle Pook, University of York

Session Type: Workshop
Abstract Number: 36

CIEC Promoting Science has been involved in developing contexts for teaching science and STEM related subjects for the past 25 years. In 2011, we launched a very successful programme in conjunction with the HEI STEM North West spoke. Through networks which involved collaboration between HE science and technology departments, secondary and primary schools, young children were introduced to the potential benefits and ultimate career prospects of studying STEM subjects,

This session will provide:

- Information about the recruitment of clusters, training process and development of sustainable relationships
- Demonstrations of some elements of the training, including activities undertaken in the classroom and access to the wide range of resources available to deliver a project of this nature
- Data relating to the success and impact of the training and subsequent outcomes
- An opportunity to reflect on the challenges of maintaining and sustaining the relationships and building future support from HE institutions

This intervention builds upon a project that involves primary aged children in problem solving practical investigations, set in industrial contexts. The practices of this project are proven to be effective and the many teaching resources that have been developed through it are available freely on the CIEC web site.
Conceptual understanding in Physics

Derek Raine, University of Leicester

Session Type: Workshop
Abstract Number: 32

This session will present an interim report on the National HE STEM Programme project, Conceptual Understanding in Physics, a collaboration between the Universities of Hull, Hertfordshire, Durham and Leicester with additional contributions from Edinburgh and St Andrews. The project aims to build multiple approaches to developing conceptual understanding: through analysis of modelling, analysis of numerical simulations, simulations of laboratory experiments and addressing directly common misconceptions. In all these examples, the focus is on directing students’ attention to a critical analysis of the behaviour of the respective physical systems in order to complement the traditional emphasis on the technicalities of problem-solving. We also report on the use of concept inventories to evaluate some of these interventions.
Improving feedback in mathematics teaching

Mike Robinson, Sheffield Hallam University
Hannah Bartholomew, Sheffield Hallam University

Session Type: Workshop
Abstract Number: 25

Both staff and students worry about student feedback. Staff report that they spend substantial effort generating feedback but that many students fail to engage with it. Students report that feedback needs improving, and in the National Student Survey (NSS) they give those questions relating to feedback the lowest scores. There are of course many examples of good practice - whether innovative or traditional - where staff are working to provide effective feedback efficiently, and increase student engagement with it.

How can we improve the feedback we give, without driving ourselves to an early grave? How can we improve the students' understanding of feedback, and their engagement with it? What feedback is effective - and which is popular - and are these the same? Inevitably, we are also interested in the NSS scores.

We have talked to staff about their feedback practice, and collected data from students exploring how they engage - or not - with the feedback we provide. Various practices have been evaluated from both a staff and student perspective. In this workshop we aim to share some findings, but more importantly to encourage participants to share their own experiences, and explore how their own practice might be improved.
Better prepared mathematics graduates: learning from employers and professional bodies

Peter Rowlett, Maths, Stats and OR Network
Edmund Chadwick, University of Salford
Tony Mann, University of Greenwich
Noel-Ann Bradshaw, University of Greenwich
Kevin Parrott, University of Greenwich
Nadarajah Ramesh, University of Greenwich

Session Type: Symposium
Abstract Number: 97

Mathematics graduates are often viewed by employers as well-equipped with technical skills but weaker on skills such as communication and teamwork. Academics are not necessarily well placed to draw upon recent workplace experience to help with this. This symposium will provide input and discussion from various National HE STEM Programme projects which looked to those outside academia to develop approaches to improve graduate skills and employment expectations among students and to develop the ability of staff to deliver this in future.

A new module at Salford incorporated employer-delivered content and involved employers in assessment of student work. A project at Greenwich delivered workshops to improve graduate outcomes for students from Black, Asian and Minority Ethnic communities. A collaborative working group from the universities of Salford, Greenwich, UCLAN, Sheffield Hallam, NWUA, the IMA and the OR Society assessed how work-related learning could be made more realistic within a university context. A collaborative project between Greenwich and Birmingham spoke to mathematicians employed in academia and industry, and to professional bodies, to produce resources for developing awareness among undergraduates of what it means to be a professional mathematician. Findings will be presented and discussion will draw out commonalities of the approaches.
Maths Arcade: developing mathematical thinking

Peter Rowlett, Maths, Stats and OR Network
Tony Mann, University of Greenwich
Noel-Ann Bradshaw, University of Greenwich

Session Type: Workshop
Abstract Number: 98

The Maths Arcade is an innovative approach developed at the University of Greenwich which engages students and staff in a mathematical community and develops mathematical thinking through playing and analysing strategy games. This approach was developed locally and extended under the National HE STEM Programme. This has been transferred as established good practice to seven new HEIs (four under the National HE STEM Programme, though with staff time provided locally, and three through wholly local support). This has developed evidence of the applicability and potential for transfer of this activity and eight examples of its use in different institutions.

The activity is very suitable for transfer elsewhere, as local support at the new Maths Arcades has shown. This session aims to give participants information about the existing Maths Arcade provision, an understanding of Maths Arcade activities as students experience this and an understanding of the potential benefits available for new adopters.
Generating Genius: From aspiration to preparation, a route to the top for disadvantaged students

Tony Sewell, Generating Genius

Session Type: Workshop
Abstract Number: 140

Building the capacity of widening participation departments to be more effective in their outreach to under-represented groups.

Generating Genius is an education charity that has successfully enabled inner-city pupils from state schools to gain places in Russell Group universities. It has developed a world-class methodology, which it has developed into a training programme. Raising aspirations through campus open days, school visits, better advice and information is fine, but achieves nothing unless the young people get the necessary qualifications.

Dr Tony Sewell the Director Of Generating Genius argues for more preparation and less aspiration. Generating Genius has now developed a number of special relationships with Universities, which has allowed the charity to effectively source the right students and help the Universities connect more effectively with the real needs of their targets groups. This innovative approach has seen students from deprived areas reach Russell group Universities to study STEM subjects.

The workshop examines a number of best practice models and seriously challenges Universities to re-think the way in which undertakes the business of wider-participation.
Is there help around the corner? Collaborative outreach within your HEI

Jayne Shaw, Oxford University
Malcolm Stewart, Oxford University

Session Type: Symposium
Abstract Number: 67

Oxford University develops and delivers a wealth of outreach activities and events, however, departmental activities are often delivered in isolation. Jayne Shaw, Schools Liaison and Access Officer for Materials Science Oxford has experience of developing, coordinating and managing a range of collaborative science outreach. In November 2011 Materials Science and Chemistry applied for funding to deliver the "RSC Outreach Package in Collaboration" through the National HE STEM Programme to initiate the development of links in activities between the two departments and increase the impact of the outreach whilst sharing the workload. The activities we delivered were for Yr9 – Yr12 from a variety of schools.

This session looks at the outcomes of this collaboration and discusses how to set up similar sustainable collaborative events in your own institutions. We invite you to share your ideas for future collaborations and look at methods of developing successful inter-departmental links and the planning required to increase the impact of the events. Finally, following the success of our Year 9 event we discuss engaging with younger students and the benefits of follow up events for students and Teachers.
trans:it science

Paul Spencer, University of Bradford
Mohan Mistry, University of Bradford

Session Type: Workshop and Poster
Abstract Number: 101

trans:it is a suite of web- and paper-based material for supporting students in making the transition from further education into higher education. It was developed in 2008-9 at the University of Bradford in close collaboration with FE and HE partners across West Yorkshire and supported by the West Yorkshire Lifelong Learning Network (WYLLN). Staff and students from both sectors were extensively involved in the development. The generic support material, along with guidance for tutors, is available at www.transit.ac.uk.

In 2010-11 we produced trans:it engineering through additional WYLLN, National HE STEM Programme and Royal Academy of Engineering support. This supplements the generic content with material specific to engineering courses.

During 2011/12 with further National HE STEM Programme support from the North East Spoke support, we have developed trans:it science. This is particularly aimed at students moving from BTEC Applied Science and related courses in schools and colleges on to science courses in higher education.

As a delegate in this participatory session, you will be able to:

- experience the new trans:it science material
- work through a sample exercise supporting students in making the transition to HE
- feedback your comments and observations
- explore ways in which you could adopt or adapt trans:it science for your own use
Media training: Creating engaging ‘short form’ video for the web

Janet Sumner, The Open University
Andrew Rix, Andrew Rix Ltd

Session Type: Workshop
Abstract Number: 139

The Open University has a forty-year history of engagement through media, and has created a programme of media training specifically for the Higher Education sector. These facilitator-led workshops are delivered by BAFTA award winning BBC trained Open University staff.

The workshops will help participants to think creatively about how audio visual assets can be used to communicate and engage with target audiences e.g. staff, students, partners, the general public. Video can be used to support and promote teaching, learning and research, present lectures, record workshop sessions, deliver learning ‘bites’, give practical demonstrations, showcase laboratories and research facilities, publish interviews with students and academics, give introductions and welcomes to students and to promote new and existing courses.

The workshops are highly interactive and participative, and include a mix of facilitator led demonstrations and practical activities. Throughout the day, participants will be given the opportunity to view and critique video footage in a friendly group environment. The aim of the workshops is to give participants confidence in front of the camera, in interview situations, and will teach them the following media production skills:

- Identifying and establishing a relationship with the target audience
- How to script, choreograph and present pieces to camera
- Interviewing: how to be a good interviewer and interviewee
- Filming: how to set up and record interviews and pieces to camera
- How to storyboard and create a shooting script

Investing in media training can add value to an institute’s output and be cost effective in terms of communicating and engaging with large or remote audiences.
Real World STEM: Scenario-based learning for STEM careers

Paul Taylor, University of Warwick
Jonathan Heron, University of Warwick

Session Type: Workshop
Abstract Number: 110

The Real World STEM project’s objectives were to stimulate students’ interest in the topicality and challenge of a STEM career and to prepare them to make a successful start on the career ladder.

Using scenario-based learning we aimed to help students:

- understand the facts, concepts, and theories of their discipline
- present scientific arguments clearly and correctly
- articulate their discipline-specific skills to match employers’ requirements

This workshop will demonstrate techniques of scenario-based learning which were used successfully with undergraduates from Maths, Chemistry, Engineering, in collaboration with academics in those disciplines and colleagues from Warwick’s Student Careers and Skills service.

The workshop will follow key elements used in the project such as active introduction games, warm-up and narrative-building exercises, and will present student feedback on these experiences.

The objective is to show how academic staff can embed student employability more firmly in the undergraduate curriculum by offering students a range of learning experiences drawing on embodied and enquiry-based learning.

The workshop will be practical in nature and will offer participants techniques which can be applied in their own contexts supported by an online video learning resource.
Developing employer-led CPD: A case study of the development of flexible and affordable workforce up-skilling provision in the North West

Adrian Toland. Manchester Metropolitan University
Edmund Chadwick, University of Salford.
Karl Jackson, South Cheshire College
Nathalie Renevier, University of Central Lancashire

Session Type: Workshop
Abstract Number: 128

Employers across the STEM industries report a wide range of skills gaps in their existing workforce at higher levels. This project set out to address some of these through the development of a range of CPD modules at HE Level 4+ aimed at those already in work with no previous experience of HE.

Initially North West Universities Allliance (NWUA) worked with the STEM cluster of Sector Skills Councils and other sectoral organisations in the North West region to understand the needs of industry for level 4+ CPD in relation to the STEM workforce. This was then compared to the current CPD provision across the region and a gap analysis produced. The gap analysis then formed a priorities document for CPD development and NW HEIs were asked to bid to NWUA to develop new provision which met these priorities in partnership with employers.

The portfolio of CPD which has been produced is employer driven and flexibly delivered to meet the needs of the current workforce. The project has delivered a suite of 26 modules (ranging from 5-20 credits) across 5 HE providers which address the needs of a wide range of STEM sectors including the aerospace, automotive, engineering, energy, textiles and construction sectors.

This workshop will provide participants with an understanding of the learning journey undertaken by NW HEIs in developing a series of CPD modules, at level 4 or above, aimed at those in the workforce with no previous experience of HE who wish to upskill themselves in the STEM disciplines of Chemistry, Physics, Maths (including statistics) or Engineering. The work built upon the best practice from the HEFCE and NWDA funded North West Higher Level Skills Partnership project (NW HLSP) which was awarded the Times Higher Education Award for Outstanding Employer Engagement Initiative in November 2010.
Evaluation of placement learning opportunities: using student-centred, evidence-based analysis of placement situations

Poppy Turner, Independent Consultant - learning in HE

Session Type: Workshop
Abstract Number: 6

Placements form a major part of undergraduate curricula. High quality placements facilitate student learning, professional development and personal growth. Some placements may fall short of expectations and, under these circumstances, students can report learning very little. Therefore, placement learning opportunities need to be evaluated. Effective evaluation of placements should be based on an understanding of placement learning, its promoters and inhibitors.

This session is based on workshops held previously at Bath. The presentation introduces the project that was carried out in collaboration with the University’s Placement Managers and built on their good practice. Handouts and activities will focus on the use of employer information, student feedback and learning theories for effective evaluation of placements through systematic analysis. Guidelines developed during the project will be available for discussion.

Evaluation of placement opportunities using this analytical method is an innovation outside normal quality enhancement practices. It could be adopted by other HEIs. Similar methodology has been used in evaluation of practical classes and other university-based learning opportunities at Bath, leading to specific recommendations for enhancement, and could also be used more widely in evaluation of undergraduate and postgraduate learning opportunities.

Guidelines and earlier workshop material are available at: http://www.hestem-sw.org.uk/project?id=52. Documentation from this project will sit alongside the University of Bath’s QA Code for placements from 2012/13.
Maths large and small outreach careers kits – hands on workshop!

David Youdan, Institute of Mathematics and its Applications

Session Type: Workshop
Abstract Number: 5

If you have ever been to a science fair you will know that they are noisy, busy and usually very hands on, with students having a chance to fire rockets, make slime and generally create a bit of mayhem! It can seem like a hard task for a HEI maths department to work out how they can fit into an environment like this. Where will they find a hands on activity which conveys the power and beauty of mathematics in a simple way?

The IMA set out to try and address this problem – the aim being to create two collections of hands on activities, one consisting of large items and the other a briefcase of smaller items. Not every department always wants to arrange shipping of a huge item to an event, so having a variety of sizes was important.

The result is two kits which reflects some of the excellent work which is already going on – making activities accessible to maths departments who perhaps have the ideas but just don’t practically have the time to get these kinds of things manufactured.

In this dynamic session you’ll have a chance to try out all the hands on activities!
Abstracts: Posters
(Presented Alphabetically by Lead Author)
Managing STEM Related work experience placements and internships

Julian Blanch, Cardiff University

Session Type: Poster
Abstract Number: 127

Graduate employability is high on the UK Government/Wales Assembly Government agendas. As an aspect of the student experience, it is right that universities take the lead on this issue.

Students take up placements and benefit from the opportunity to enhance their understanding of career choices, aspirations for future employment and to improve their employability. The placement or internship provides a tangible link between theory and application.

The STEM Placement Toolkit provides information and guidance on the design, management and maintenance of periods of placement learning. The toolkit acts as a concise reference point for information on key issues, outlines relevant requirements and good practise expectations. Its primary purpose is to help STEM schools provide periods of placement learning and study away that enriches the student experience and are valued by employers.
The new statistics advisory service on the block

Katy Dobson, University of Leeds
Liz Meenan, University of Leeds

Session Type: Poster
Abstract Number: 19

In the past 2 years there has been a steady increase in the provision of statistics support offered to students by Maths Support Centres (MSC) and in 2012 Skills@Library at the University of Leeds set up a Statistics Advisory Service (SAS) as an extension of our already successful MSC.

This poster will explore the ways in which the award winning Skills@Library Maths Support Centre has sought to try and enhance the statistic provision. The main focus of our new SAS was to offer statistics help and advice to students across the University primarily by a dedicated statistics weekly drop-in and an appointment service. These appointments are then either taken online via Adobe Connect Pro or in person. We have also begun to extend our paper and e-based resources and we aim in the coming months to cover all areas of statistics. Since the SAS has been set up many more students have found the statistics content of their courses more manageable and many have used their enhanced knowledge to improve their final year and Masters projects.
Automated evaluation of mathematics support

Ant Edwards, University of York

Session Type: Poster
Abstract Number: 35

The University of York’s Maths Skills Centre uses an innovative approach to the collection and analysis of student usage data. This poster will outline our automated procedure, demonstrating collection methods, analysis and outputs.

Student data is collected via scans of student card barcodes. This data is stored on the barcode scanner and uploaded via a python script to an excel spreadsheet. Then, the Student Information database is queried to obtain student departments and year groups, and all other data is encrypted by a cryptographic hash function, rendering student data completely anonymous - even to the person collecting and storing it. Finally, graphs are automatically generated for monitoring activity and reports to senior management.

This approach has the following benefits:

- Student data is anonymous throughout the procedure
- Stored data is hash encrypted (so that it cannot be unencrypted by anyone)
- The procedure of data collection is streamlined for students and staff
- Graphs that need to be regularly used are produced automatically
- Staff can monitor usage on-the-fly, without managing or searching for large volumes of data
Use of blended learning approach to enhance workforce chemical knowledge

Lata Gautam, Anglia Ruskin University
Sheila Pankhurst, Anglia Ruskin University

Session Type: Poster
Abstract Number: 134

In order to improve understanding of the basic chemical processes, we have developed work-based learning resources for production staff in the chemical industry via blended learning approach (i.e. using both the Virtual Learning Environment or VLE and face-to-face delivery). The project arose from the employees’ desire to increase their knowledge about the chemical substances they work with and the employers’ need to enhance the skills of their workforce to their commercial benefit. For this, we have worked closely with our industrial partner, Huntsman Chemical Company to fully understand their need. When our academic and technical staff spent time working at their production facility, it was established that a series of flexible work-based accredited short courses would be beneficial. Two modules, 15 credit each at level 4 have been prepared, validated and are now running. The Concepts of Harm and Ecotoxicity reflects the way chemicals used in industrial process can adversely affect the workforce, the wider population and the environment. The focus is on the health and safety aspects of working with the chemicals. Principles of Chemical Reactions and Polymerisation covers both the basic concepts and practical aspects of chemical reactions, reaction mechanisms, energetic, catalysis and polymerisation.
Engaging with employers to enhance employability in mathematics at the University of Leeds

Samantha Pugh, University of Leeds
Margit Messmer, University of Leeds
Kevin Houston, University of Leeds

Session Type: Poster
Abstract Number: 59

This poster will summarise the work carried out in the “Engaging with Employers to Enhance Employability in Mathematics” (E4M Project). This project has focussed on graduate skills development in Mathematics, by forming partnerships with those employers who regularly recruit Maths students from the University of Leeds. We are working with employers to develop case studies, activities/assessments and mini-projects that encompass these skills. Experience/research has shown that the development of skills is much more effective when they are integral to the curriculum and include employer input. Activities span all levels of programmes, and skills will be developed and augmented as students progress through the levels.
Business skills for Chemists – Chemistry: idea to market

Samantha Pugh, University of Leeds
Stephen Maw, University of Leeds
Patrick McGowan, University of Leeds

Session Type: Poster
Abstract Number: 60

Throughout any Chemistry degree, students learn about how to synthesize/create a wide range of different molecules and materials, but there is little consideration of how that initial molecule could become a commercial product. The main aim of this project was to develop a module that would educate students about the various stages that a new concept has to pass through in order to successfully become a commercial product. This is best achieved by students working through the entire process via a simulated case study.

A series of case study scenarios have been developed, alongside targeted skills workshop, to form a vehicle to encourage students to carry out research into a technical area, of relevance to chemists, whilst developing a range of transferable skills. This poster will complement a workshop session that is proposed by all of the ‘Royal Society of Chemistry business skills for Chemists’ projects.
Engaging young people in learning about nuclear energy for future careers

Liz Whitelegg, The Open University
Sam Smidt, The Open University

Session Type: Poster
Abstract Number: 122

This poster will showcase the materials produced for the Open University's 'Unsure about Nuclear?' project that aims to interest young people (18 to 25 year olds) in learning more about nuclear energy so that they will be well placed to investigate opportunities for careers in this industry.

The materials consist of a fun and entertaining 'app about young people's energy usage and of the options for sustainable energy supply. This leads into a 15 hour online course that is available from the Open University's open access website Open Learn (www.open.edu/openlearn).
Chemistry clips - Multimedia resources for teaching problem solving in chemistry

Dylan Williams, University of Leicester
David Davies, University of Leicester

Session Type: Poster
Abstract Number: 54

One of the main difficulties in communicating science to undergraduate students is ensuring that the thought process behind key concepts is communicated effectively. Whilst such information is usually given in lectures, it is often not recorded by students who tend to focus on the result rather than the process. In addition, when revising, students have often forgotten the explanation of the process and have to rely entirely on printed resources; hence they often find it difficult to apply these principles to ‘related questions’ in exams and tests.

The use of multimedia resources has become increasingly significant in undergraduate chemistry teaching recently. A number of implementations of multimedia resources have recently been demonstrated ranging from full lecture capture to screen capture clips.

A series of short focused multi-media resources were developed based on areas of the chemistry degree course that students often have difficulty with. The resources were generated by producing PowerPoint slideshows and using Adobe Connect to add speech. Incorporation of animations and other interactive elements was found to be much more difficult. Evaluation of student attitudes towards the resources revealed that they were appreciated by students and they were particularly useful for distance learners and for exam revision. A number of improvements were suggested such as the inclusion of more in-depth content. The development of these types of resources can be done by final year undergraduate project students.

This poster will describe the production of these resources as well as the findings from an evaluation of the use of the clips by undergraduate students on the chemistry and i-science degree courses at the University of Leicester.
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