

## Royal Academy of Engineering

### Visiting Professors Conference: What is excellence in engineering teaching?

#### International Element

25 – 27 September 2017

#### Key Facts:

- 56 attendees from 16 countries attended
- 40% of the attendees were female, and 50% of the speakers were female
- Attendees represented both industry and academia

#### Key Outputs:

- There is a need to secure a buy-in from students through project based learning as it helps students understand why they are learning
- As technology develops, there is an opportunity to compliment more traditional teaching methods with MOOCs and online learning; creating a blended approach and utilising face-to-face teaching time more efficiently.
- There is a need to teach engineer students soft skills and business skills to enhance their ability to create jobs and innovate.

The [Visiting Professors](#) scheme is one of the academy's longest running programmes, creating valuable and in-depth relationships between the UK's higher education institutions and engineering industry. Based on a programme of industrialist secondments or **Visiting Professors**, supported by university academics or **Academic Champions**, undergoing a yearlong secondment to a UK university the aim of the programme is to bridge the gap between industry and academia.

This has played a vital role in the shaping of the academy's international programmes; [Industry Academia Partnership Programme \(IAPP\)](#) and [Higher Education Partnerships in sub-Saharan Africa Programme \(HEP SSA\)](#).

IAPP, which is currently in 7 countries, aims to strengthen the capacity of the partner country's universities to carry out excellent teaching, research and innovation-related activities through collaboration with industry and UK counterparts. Similarly, HEP SSA, which is currently in 9 countries, through forming and strengthening relationships between academia and industry, aims to ensure that the higher education system in sub-Saharan Africa produces engineers with the skills and knowledge required to meet the needs of industry and to tackle local challenges.



Professor Perkins keynote on engineering skills

For the second year running, the UK Visiting Professors scheme, and the International IAPP and HEP SSA programmes collaborated to consider engineering education globally, utilising the truly diverse

and experienced engineers; both from industry and academia, that took part in the conference to identify excellence in engineering education.

The international element, chaired by Dr Jane Butler FREng, Vice Dean Research, UCL, focussed on excellence in engineering education in three specific areas:

- Improving employability
- Promoting new teaching methods
- The role of entrepreneurship and innovation in engineering education.

This offered an opportunity to convene the Academy's UK and International partners, share different approaches to engineering education, and seed potential collaboration opportunities ahead of upcoming funding opportunities.

The day began with a thought-provoking keynote by Professor John Perkins CBE FREng providing an overview of the Perkins Review published in 2014, looking at the global need for skills in engineering. Professor Perkins identified several key takeaways for the delegates:

1. Many engineers take the apprenticeship route. With the high costs of degrees and support by industry and government for apprenticeships, this is an interesting space to watch in training future engineers.
2. We need to inspire girls into engineering before they reach university: In a report by Professor Perkins, *'Review of Engineering Skills, BIS 2013 quoting: Polling for Tomorrow's Engineers Week'* it states that less than half of parents of girls thought engineering was a good career for girls, and only 9% of UK engineers are females. We need to work with primary schools to inspire girls into engineering.
3. Do we need maths and physics? With physics being the most unpopular subject for girls, we need to broaden entry requirements into programmes, project work and industry engagement in design and delivery of courses as well as experience of workplace for students greatly improves student's appetite for engineering.

### **Session 1: Improving Employability through Engineering Education**

The first session was chaired by Dr Waessara Weerawat, Mahidol University, Thailand. This session aimed to look at improving employability of engineering graduates who are 'industry-ready'.

Professors Mona-Lisa Dahm and Gajenthiran Velmurugan from Aalborg University, Denmark discussed the implementation of Problem-Based Learning into university curriculum and teaching



Session 1 chaired by Dr Waessara Weerawat

approaches to create more industry ready graduates. They provided quantitative data that suggests Aalborg University has benefitted from the implementation of Problem-Based learning with graduates faring better in employment compared to other competitor university institutions.

This fresh look at Problem-Based Learning and its positive effect on a graduate's employability was complimented by Professor Bao Hong, Vice President, Beijing Union University, China, who discussed Beijing Union University's approach to providing its students with practical projects and the need to relook at engineering education, to break away from traditional teaching practice of software and hardware majors and provide a learning platform for intelligent vehicles as artificial intelligence changes the working world, to ensure students are equipped with the skills needed for the engineering jobs of the future.

## **Session 2: Improving Methods of Engineering Education**

The second session, chaired by Dr Annatoria Chinyama, Acting Dean of Engineering, National University of Science & Technology, Zimbabwe, opened discussions on adopting new teaching methods and cutting edge technology to improve excellence in engineering teaching and improve the impact on students.



**Session 2 chaired by Dr Annatoria Chinyama**

Dr Anh Tran and Dr Lizzie Miles, Coventry University, UK, began by presenting on the university's humanitarian engineering approach. This focussed on engineering and computing in a culturally appropriate way with local, national and international participation; engaging local communities in its engineering courses whether that is in Coventry or within the developing world. Dr Tran and Dr Miles suggested that girls are more interested in supporting engineering when it has a humanitarian approach combining ethics with engineering. This presentation suggested that teaching should be research-inspired, considering the context of the lessons rather than the content to ensure that students care about the outcome of their lessons and therefore, are more likely to learn.

Building on from creating more engaging approaches to teaching; Dr David Miranda, Industrial University of Santander, Colombia, advocated Just in Time Teaching (JiTT) as an effective approach to ensuring students learn more effectively, whilst allowing the lecturers to direct the content of their lessons where is most needed by the students. Dr Miranda explained that lecturers using JiTT set tasks for their students up to 36 hours prior to the class, allowing for a minimum of two hours prior to the lesson to allow for the lecturer to mark the tasks – thus creating a more effective learning environment. This teaching approach is used by an increasing number of teachers and lecturers throughout the world, and whilst it demands a complete teaching methodology overhaul for the lecturer, the results show an improved learning environment for the students.



Finally, this session concluded with a presentation from Professor Andrew Rae, University of Highlands and Islands, Scotland, and Prof Susheel Mittal, Thapar University, India, both incorporating new technology to address unique challenges faced by each university's engineering curriculum. Professor Rae explained how in an era where knowledge is more accessible, and with an increased number of students to teach spread over a large geographical area in the Scottish Highlands, lecturer to student time is even more valuable than before. Introducing flipped classrooms, where knowledge is downloaded outside of class through short video conferencing, has allowed face-to-face teaching to concentrate on lab and practical work rather than textbooks. Professor Mittal further defended the use of the internet as a teaching tool. With the old style of teaching outdated due to enlarged classes, and students with different learning styles and backgrounds, the internet has revolutionised the teaching process (although not completely replacing the utility of classrooms). Through a blended approach, the internet is used as the prime educator whilst the teacher is the facilitator within the classrooms. Universities can utilise the success of MOOCs, and help universities and teachers reach a wider audience of learners, whilst maintaining the high teaching standards expected from their students.



**Professor Peter Goodhew CBE FREng chaired the main conference**

### **Session 3: Entrepreneurship and Innovation in Engineering Education**



**Session 3 chaired by Professor Alison Noble OBE FREng FRS**

In this final session, chaired by Professor Alison Noble OBE FREng FRS, University of Oxford, UK, we heard from two different approaches to utilising and incorporating entrepreneurship and innovation into engineering education. With a high unemployment rate in the developing world, particularly in Africa as it marches towards producing the largest workforce in the world by 2040, the ability to stimulate economies, create jobs and innovative approaches to societal problems, is more acute now, throughout the world, than even before.

Dr Alastair Moore, Head of Innovation and Entrepreneurship, UCL, UK, showcased the London based university's approach to intertwining students, entrepreneurship and engineering education. Dr

Moore explained that students should be connected to institutions, building research activity into pedagogy. He further explained that the syllabus should include workplace learning, and understanding of commercialisation/market opportunities and intellectual property. It is important to train engineers that see innovation and entrepreneurship as part of their training rather than an addition.

The final presentation of day one looked at the implementation of innovation and entrepreneurship within mass transit and highway infrastructure between Bandung and Jakarta, Indonesia. Dr Sigit Santosa, Institut Teknologi Bandung, presented on the Indonesian university's steps taken to create a national research centre to support engineering development capabilities focussed on an ecosystem of product development and industrial implementation; enabling the country to create a mass transport system where students work with industry as well as industry working with universities for the countries benefit.



Yasmin Ali shares her experiences as a recent graduate

## Day two

Following the international element of the conference on 26<sup>th</sup> September 2017, the academy's international awardees joined the UK Visiting Professors to further discuss excellence in engineering education, seed potential collaborations and exchange ideas on 27<sup>th</sup> September 2017. This was chaired by Peter Goodhew CBE FREng, Emeritus Professor of Engineering at the University of Liverpool, and Chair of the Visiting Professors Scheme's Steering Group. The day began with a welcome from Professor Alec Cameron, Vice-Chancellor, Aston University, UK. This was followed by a series of interesting and engaging presentations, this included:

- Dr Catherine Hack, Higher Education Academy, UK attempting to define what excellence is in engineering education,
- Dr Bhupesh Lad, Institute of Technology, Indore, India, discussing the need to blend research with education to create excellence,
- Dr Georgia Kremmyda, Warwick University, UK, on the development of humanitarian engineering and Warwick's inter-disciplinary approach to engineering education,
- 'Experience Led-Learning' by newly elected Visiting Professor at Imperial College London and Director of Think-Up, Dr Oliver Broadbent,
- and an engaging presentation from Yasmin Ali, and her experiences of recently studying engineering.

The conference provided an opportunity for the Royal Academy of Engineering's UK and international awardees and partners to share experiences, knowledge and plant seeds for future collaboration and partnerships as well as showcasing the important work that the Royal Academy of Engineering supports throughout the world in promoting and improving engineering education.