

**Engineering Education Research Special Interest Group
(EER SIG)**

**2nd Annual Symposium: *The Sustainable Impact of
Engineering Education Research***



The EER SIG (originally part of the HEA Engineering Subject Centre) is made up of a number of engineering educators and researchers from universities across the UK. The aim of the SIG is to promote and enhance engineering education through the use of empirically grounded evidence-based practice.

Registration Information

Registration requests should be made by emailing the following information to;
ee.engineereducation@northumbria.ac.uk

- Name;
- Affiliation;
- Email address;
- Special dietary or access needs;

Attendance at the Symposium is free of charge but places are limited and will therefore be allocated on a 'first come first served' basis, place allocation will be confirmed by email.

Programme

09:40	Registration with Tea & Coffee
10:15	Welcome and introduction
10:30	<p>How to teach engineers (and others) about sustainability <i>Michael Clifford, Subarna Sivapalan, & Sarah Speight</i></p> <p>Teaching engineers (and others) what it means to live and practice in a sustainable manner is no easy task. The Institute of Mechanical Engineers insist that “accredited degrees should incorporate... environmental issues and sustainability throughout the degree” but is less prescriptive when it comes to defining sustainability, let alone directing how these issues can be embedded or integrated into engineering curricula.</p> <p>At the University of Nottingham, funding from JISC and the institution has been used to develop a series of open access resources to allow learners from inside and from outside of higher education to investigate the subject of sustainability. Web-based resources delivered through a virtual learning environment, an extra-curricular not-for-credit module, various e-books and a massive open online course have populated a rich landscape of learning environments for participants to explore.</p> <p>This presentation will discuss the general subject of how to teach engineers (and others) about sustainability and will share stories from the plethora of learning experiences.</p>
10:50	<p>Teaching Engineering to Non-Engineering Teachers <i>Lewis CR Jones, John R Tyrer, & Nigel P Zanker.</i></p>

Engineering is seriously underrepresented in school Design and Technology (D&T) education, yet represents a major employment opportunity for many students. Our initial work developed Science, Technology, Engineering and Maths (STEM) projects to improve the use of common D&T equipment such as laser cutters. The pupils' responses to these types of projects are encouragingly positive, but the level of technical understanding pupils gained was low. (Jones, Tyrer, & Zanker, 2013) We have experienced resistance from teachers when they have to deliver STEM content alone. Analysis of a sample of D&T teachers, all who completed their PGCE training at Loughborough University, have revealed what we believe to be the core problem. Only 11% of teachers had studied engineering prior to their PGCE. Our prior research has shown that there is a need to improve the engineering knowledge of teachers.

To resolve this lack of appropriate subject knowledge in teachers we have developed an engineering focused Continuing Professional Development (CPD) programme. Delivering engineering education to teachers on using and teaching with the modern manufacturing equipment that is in their classrooms. This requires the adaptation of our undergraduate modules content for use in schools, without oversimplify. Also using engineering education pedagogies, including lab based teaching, to deliver content to teachers the majority of whom have a creative arts background.

Results from the daylong course showed that teachers were now more likely to deliver the technical and engineering content and that they had expanded their learning beyond just operating the machine. Teachers gained a deep understanding of the knowledge and technology that we would normally deliver to engineering undergraduates. This will have an impact on their students as those teachers are now more able to teach engineering. By giving teachers the skills and knowledge they require to deliver STEM content the university is capable of impacting on a much wider audience of young pupils, compared to running single day STEM activities in a few schools. Better equipped teachers will be able to sustainably deliver this type of content for many years. CPD courses will also fill the gap within the university and teacher training sector caused by the closure of many PGCE courses. Pedagogic research in engineering education allows us to continually measure and evaluate the quality of teaching and learning through this project to ensure impact in schools.

References Jones, L. C. R., Tyrer, J. R., & Zanker, N. P. (2013). Applying laser cutting techniques through horology for teaching effective STEM in design and technology. *Design and Technology Education: An International Journal*, 18(3), 21– 34.

11:10 Discussion of points of interest from the first presentation session.

11:30 Tea & Coffee

11:40 **Publishing Engineering Education Research**

Judith K Shawcross and Tom W Ridgman,

Engineering Education (EE) Research should be published, either in appropriate journals or relevant conference proceedings, to facilitate its dissemination and uptake. New practices can then be adopted to deliver sustainable improvements and also demonstrate the positive impact of EE Research.

A key issue in the emerging field of EE in the UK is that many of the journal options have both low impact and a low profile particularly among the large community of practising Engineering Educators. The three aims of this research were; to determine the journals that are relevant to the EE research community, examine current publishing practice in the EE community and identify aspects seen as barriers or problems relating to the publication of EE research. The first aspect was undertaken via literature and web searches and the other aspects through a survey of UK EE researchers.

There are a large number of different types of journals that might be relevant for publishing EE research which include those focusing on Higher Education, STEM Education, Continuing Education and specific engineering disciplines as well as EE. This research just focusses on those specific to EE. Twenty six different journals were identified as being relevant. Only seven had 2012 ISI Impact Factors, and of these only the Journal of Engineering Education had an Impact Factor greater than 1. Comparisons were made with other recent studies on EE journals and it was determined that there does not appear to be an actively managed and publicly available comprehensive listing of EE journals.

Thirty four people responded to the survey from twenty one different academic institutions. 91% were based in Engineering Departments and the remainder in academic support units. Data collected on academic position and time spent undertaking EE research would suggest that EE research is mostly undertaken by academics and teaching staff on a part time basis with very little by dedicated research staff or students.

In terms of publications the most highly used journal was Engineering Education: Journal of the Higher Education Academy Engineering Subject Centre with European Journal of Engineering Education (EJEE) a clear second. In terms of conferences the most highly used was the bi-annual UK Engineering Education conference with the SEFI conference (European EE) a clear second. In this sample of researchers there was 3:1 ratio of publication via conference papers to journal papers.

Eight key issues were identified relating to publishing EE the most common three were lack of acceptance and recognition of EER in the UK EE community, the lack of support/resources for EER in the UK and lack of information about EE journals and conferences. Six recommendations are made that would help serve the UK and wider EE community. These would benefit from being debated within the community so that an action plan

	<p>can be developed for implementation.</p> <p>The paper associated with this abstract can be found at this link: http://www.heacademy.ac.uk/resources/detail/disciplines/engineering/report-publishing-engineering-education-research</p>
12:00	<p>Big and small, seeking a sustainable pedagogy. <i>Jenna Tudor, Michael Hush, Roger Penlington</i></p> <p>A look at what can be learned from contrasting pedagogic practice in the Open University with a traditional full-time classroom setting to develop an objective of making engineering education values and student learning more sustainable.</p>
12:20	<p>Discussion of points of interest from the second presentation session and introduction to lunchtime activity.</p>
12:45	<p>Lunch break continuing with, Posters, Networking, proposals, a good read</p> <p><i>During the lunch break there will be the opportunity to view posters by PhD students and of other projects, to share work in progress and to develop opportunities by networking. To disseminate the full range of published material of interest to EER examples of contributors 'recommended recent reads' will be available</i></p>
14:00	<p>Moving Up to University: Facilitated Peer Mentoring in 1st Year Engineering Education – A Case Study <i>Jane Andrews, Robin Clark</i></p> <p>Introduction: Developed as a means of tackling first year undergraduate engineering student attrition, Peer Mentoring was introduced into two Engineering Subject Groups in 2013 (Chemical Engineering & Computer Science). Based on a model of Peer Mentoring developed by the two presenters, (Clark et al., 2013; Andrews et al, 2012), an 'opt-out' model of peer mentoring was launched in which 1st year students were allocated to purposefully constructed 'mentoring groups' each one of which was headed by a 2nd year peer mentor. Facilitated 'mentoring activities' were timetabled within the curriculum and all students strongly encouraged to participate. Purposefully designed so as to capture evidence of 'what works', an engineering education research study was undertaken concurrently with the mentoring programme to critically examine the impact of mentoring on students' experiences as the academic year progressed. It is this study that this presentation focuses upon.</p> <p>Methodology: Starting with the research question "Does peer mentoring improve engineering students' transition into university?" an Action Research Study was conducted following a mixed methodological approach.</p> <p>Discussion: Highlighting the social, academic and professional aspects of student transition, the presentation will examine the challenges faced by new students. It will consider how purposefully managed peer support can assist in aiding transition into university for engineering students. Looking specifically at how peer mentoring can help first year students overcome the barriers and challenges of the first term in university, the presentation also draws attention to the benefits of mentoring from the 2nd year mentor perspectives.</p> <p>Output: The final part of the discussion will introduce a working model of Peer Mentoring for use in Engineering Faculties based upon the emergent study findings.</p> <p>REFERENCES: Andrews, J., Clark, R., Thomas, L. (2012). Compendium of Effective Practice in Higher Education Retention & Success. York. Higher Education Academy. ISBN 978 1 85449 427 6. Available at: http://www.heacademy.ac.uk/assets/documents/what-works-student-retention/What_Works_Compendium_Effective_Practice.pdf</p> <p>Clark, R., Andrews, J. & Gorman, P. (2013). "Tackling Transition: The Value of Peer Mentoring". What Works? Special Edition of the Journal of Widening Participation and Lifelong Learning. 14. pp. 57-75.</p>
14:20	<p>Learning from other STEM subjects: what can Engineering Education learn from pedagogy and sustainable practice in Science? <i>Helen Hooper</i></p> <p>As class sizes continue to grow in many STEM areas there is a constant question about how we can engage students from large cohorts in activities which are not credit bearing. A case study format will be used to present examples of techniques used to successfully engage large classes in formative activities.</p>
14:40	<p>Discussion of the afternoon papers</p>
15:00	<p>Tea & Coffee</p>
15:10	<p>Discussion: Building EER capacity</p>
15:40	<p>Close</p>