Learning and Teaching in Higher Education: Research, Collaboration and Dissemination – A UK Perspective

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School of Engineering and Applied Science

Presentation at UPC, Barcelona – February 2012
The Plan

- A little about me
- The Higher Education Landscape
- Engineering Education at Aston
- Our Approach to Learning and Teaching
- The Role of Research
- Collaboration and Dissemination
- Where next?
- Final thoughts
Who am I?

- Mechanical Engineering at UCL (BSc and PhD)
- Non-Destructive Testing and Evaluation
- From nuclear reactors to rail
  - AEA Technology
  - Rolls Royce and Associates
  - British Rail
  - Sperry Rail (MBA)
- Aston in 2003
  - PGCPP
  - National Teaching Fellow
The Higher Education Landscape

SECURING A SUSTAINABLE FUTURE FOR HIGHER EDUCATION

AN INDEPENDENT REVIEW OF HIGHER EDUCATION FUNDING & STUDENT FINANCE.
12 October 2010
www.independent.gov.uk/brown-report

Aston University
Birmingham
Time of Change

- Changing demands (global and national)
- Opportunities for us all
- Browne Review (October 2010)

“No one should lose sight of the powerful role that higher education will play in continuing to build the greatness of this nation”
The Challenge

“The engineering profession is an important stakeholder in enabling the world to adapt to climate change and engineers themselves need to be provided with the opportunities to respond to the challenges” IMechE

Grand Challenges for Engineering – National Academy of Engineering (USA)
Aston University

- Founded in 1895, University since 1966
- Campus in Birmingham city centre
- Student population: 9000+ (just over 1,700 International students)
- Industry-focused and accredited programmes
- USP - Employability
- Engineering and Applied Science, Life and Health Science, Business and Languages
- Industrial placement year (80%)
- Graduates entering employment (92%)
- A top 30 UK University
Engineering at Aston

- Mechanical / Electrical / Chemical / Computer Science / Information
- Engineering Systems and Management
  - Construction
  - Environmental
  - Logistics
  - Focus for management teaching in Engineering
Engineering Education

- How attractive is the subject to young people?
- Are students prepared for a course of engineering study?
- Do young people know what it is?
- What are the career prospects on graduation?
Starting a buzz

What questions do you ask yourselves about the students (incoming, current and departing) on the course you most associate with?
Aston University Total Engineering Education

Excite and inspire

Curriculum pathways

Employability

4 - 13 year olds

Engineering Academy

14 - 19 year olds

Aston University
S+V+R = Student Success
So...

- **Synergy** – beyond alignment – pre-university to LLL
- **Variety** – how we engage students
- **Relationships** – despite the technology, contact is valued

- **A Vision of Students Today**
What Else?

- Passion for teaching and subject
- Create an environment for success
  - Challenging
  - Deep learning
  - OK to make mistakes
  - Fun
  - Passion for learning

- ‘The Last Lecture’ – Randy Pausch
‘In our modern-day economy, customers’ needs are changing rapidly, competition is becoming global and technology is advancing at an ever-increasing speed. To maintain competitiveness is such a challenging environment, companies need effective leaders who understand technology and business. Engineers with proper management training have great opportunities to make valuable and lasting contributions.’

‘Engineering Management – Challenges in the New Millennium’, C M Chang, Pearson, 2005
Synergy

- Bring together learning and the world
- Employability
- Learning outcomes – curriculum – assessment
- Making clear the reason why

- ‘Teaching for Quality Learning at University’

- COHERENCY + RELEVANCE
Variety

- Discussion
- Video
- Audio
- Case study
- Role play
- Games
- Buzz group
- Puzzles
- Presentation
- Shared experiences
- ‘Book club’
- Clickers
- Lecture (teacher and student)
- .....

Case Studies

- Project Management
  - Active Learning
  - ss Great Britain
- Management of Change
  - Role Play
  - Reflection at the Back to Backs
- Market Analysis
MISSION STATEMENT

- WMPC is the UK’s leading pool design and construction company.

- Our aim is to continue to be a leading developer in the aquatics market and deliver value through excellence in design, innovation, quality and customer interaction.
Role Play

- Evans Toy Company
- Scenarios
  - Re-organisation
  - Outsourcing
  - Relocation
  - Acquisition
- Management and Workforce
  - Communication
  - Conflict
  - Teamwork
Reflection at the Back to Backs

- Pitch for training
- Out of ‘comfort zone’

- History
- Globalisation
- Change
Market Analysis

- Podcast – ‘Wake Up’
- Video – ‘Tipping Point’
- Social Media
- Marketing Plan
Non-Destructive Testing

- Head surface defects
- Horizontal defects
- Transverse defects
- Diagonal crack in web
- Vertical longitudinal split defects
- Star cracks at bolt holes
Something familiar
Non-Destructive Testing

- 70 degree probe coverage
- 37 degree probe coverage
- 0 degree probe coverage

RSU tyre

- 0 degree probe
- 37 Frw degree probe
- 37 Rev degree probe
- 70 Rev G, C & F degree probes
- 70 Frw G, C & F degree probes
Relationships

- Builds understanding
- Builds trust
- Demonstrates commitment
- Listen – Post-Its
- Cultural awareness
- Assessment and Feedback
- Engagement
- Willingness to take responsibility for learning
- Less strategic!!

The Student Experience
So…

S + V + R = Environment for Success
Now ...
Gaining Support

- ‘The Perfect Storm’
  - Tensions remain – Teaching v Research

- PGCert for all new starters
- L+T Forum for all
- Raising the standard – FHEA
- Engineering Education Research Group

- Sharing
- Understanding
- Collaboration
EER – does it have an identity?

- It’s getting there!
- Active global community
- Patchy in places, strong in others
It is tough!

- Barriers
  - Recognition
  - Credibility
  - Purpose
  - Feeling of a constant need to justify ourselves
- Challenging
  - Blending the disciplines is not trivial!
  - Funding opportunities
Looking at Europe

- SEFI Engineering Education Research Working Group
  - Aalborg 2008
  - Trnava 2010
  - Lisbon 2011
  - Leuven Summit 2011
Focus

- Building a European Community
  - What is going on?
  - Developing a taxonomy for EER in Europe
Trnava 2010

Building the Foundations
- Engagement and Training
- Outreach and Collaboration
- Visibility and Dissemination

Thoughts
- Barriers – recognition
- Position paper
- Differences as opportunities
- Don’t ‘reinvent the wheel’
- Promote national groups and co-operation across countries
- Face-to-face networking
- Roundtable at conference
- Develop website for the community
- Engineering Educators Exchange Network
- EER in pedagogical training
- Evidence
Trnava 2010

Taxonomy for EER in Europe

- EUGENE Project drive

Thoughts

- Common framework and language
- Objectives
  - Describe the landscape
  - Recognise expertise
  - Set priorities
- Taxonomy by ...
- Exclusive or inclusive
- Guide newcomers
- Object or purpose
- Literature characterisation
<table>
<thead>
<tr>
<th>Outcomes of education</th>
<th>Process of education</th>
<th>Stakeholders of education</th>
<th>Organisation for education (academic social world)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ultimate purpose</strong></td>
<td>International / national level</td>
<td>Society - incl taxpayers</td>
<td>Context (society, profession)</td>
</tr>
<tr>
<td>Sustainable society (social, economical and ecological)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Values</strong></td>
<td>Institutional level</td>
<td>Students and family</td>
<td>System structures - rules, managing structures</td>
</tr>
<tr>
<td>Critical thinking, diversity, creativity, innovation, intellectual rigour, ethics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Engineering competences</strong></td>
<td>Curriculum (program) level</td>
<td>Working life - industry, professional bodies, practicing engineers, graduates</td>
<td>Praxis within the organization (what people do)</td>
</tr>
<tr>
<td>Integration and application of knowledge. Enabling skills (incl teamwork, communication)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Technical knowledge</strong></td>
<td>Course (module) level</td>
<td>Higher education/university</td>
<td>Culture (what people say and think)</td>
</tr>
<tr>
<td>Conceptual understanding of content</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning activity</td>
<td>School</td>
<td>Identity (who people are or see themselves)</td>
<td></td>
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</table>
Workshop and sessions in Lisbon the ‘best ever’
Develop the ideas further
EJEE papers for 2012 / 2013
- State of the Art (Robin, Aston)
- Taxonomy (Lauri Malmi, Aalto)
- Methodologies (Jonte Bernhard, Linkoping)
What is the value of EER?

- Research based development of EE
- Theories and methodologies come from educational research … but we need to adjust
- Research relevant to practice
  - Research questions and topics
  - Relevant methods
  - Dissemination of results within the community
  - Understanding the discourse of EE - especially the language and concepts

Anette Kolmos, 2011
Creating some clarity

<table>
<thead>
<tr>
<th>Excellent teaching</th>
<th>Involves good content and teaching/learning methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarly Teaching Engineering Education Development</td>
<td>HOW TO DO IT</td>
</tr>
<tr>
<td>Scholarship of Teaching</td>
<td>WHAT CAN I LEARN AND HOW TO DO IT</td>
</tr>
<tr>
<td>Engineering Education Research</td>
<td>research questions, research methodologies, theories and critical interpretation of the results, research training – WHAT ARE THE REASONS AND WHAT COULD BE POSSIBLE SOLUTIONS</td>
</tr>
</tbody>
</table>
Where do we want to be?

- PhD in EER
- Successful applications for EU funding
- Build on the discussion – networks
- Engage more people
- Workshops for PhD students
- More freedom to do things we want
- Focus on achieving good results
- Deans and provost as part of the networks
- Acceptance of activities
And more

- Overview of activities and not only focus on English language – mapping what is going on
- Collaboration and learning different subject languages / concepts
- Shared understanding of excellence in EER
- Seminars for young professors … post graduate programme
- Recognition for EER – academic and political and in practice
- More international collaboration
- Getting more in contact with companies … and users of EER

- Marie Curie Application to EU
Driving Change

- Educational
- Industry / Professional
- National / International

- Don’t forget the students!

Aston University
Birmingham
Something to consider

I used to hate writing assignments, but now I enjoy them.

I realized that the purpose of writing is to inflate weak ideas, obscure poor reasoning, and inhibit clarity.

With a little practice, writing can be an intimidating and impenetrable fog. Want to see my book report?

“The dynamics of interbeing and monological imperatives in Dick and Jane: A study in psychic transrelational gender modes.”

Academia, here I come!
Writing a Research Paper (1)

- **Conception: Introduction**

- **Context**
  - Background information. Usually literature review. But also any relevant background information that is not methodology. Main theories and concepts may be discussed at this stage

- **Content**
  - Methodological approach – clear outline of methodology. Justification of methodological approach (why, limitations)
Writing a Research Paper (2)

Content
- Description of findings (either quantitative or qualitative)
  (presentation and descriptive comment)

Critique
- Analysis & critical discussion of findings
- EVALUATION
- Conceptualisation / Contextualisation of findings
- Identification of emergent themes
- Discussion regarding how research has contributed to knowledge
  (refer to previous knowledge)

Conclusion
- Future research possibilities
- Concluding remarks. Draw together rest of paper. Clearly articulate value of paper
Group thoughts

- In pairs or a small group, discuss your thoughts on the following questions:
- Where do you publish?
- Where do you go to explore the literature?
- What challenges do you experience in your writing / literature work?
Where do you publish?

Context

- Conferences – SEFI
- EE Conferences – REES
- Book chapters
- Recognition – citation report – IJEE, EJEE(?), Proc in Social Behaviour
- In house journal (Barcelona) – 1st step

- 5 EE Journals
- JEE, AJEE, EJEE, IJEE, IGIP, IEEE Trans, EE, Assess and Eval in HE
- Specialist – Technology Management
- Theme specific conferences
- EARLI conferences

Lisbon, 2011
Where do you go to explore the literature?

- ERIC database
- People – specific authors, sharing with knowledgeable people
- Google and database search tools
- Google Scholar
- Scopus
- Web of Knowledge
- Questions to colleagues

- Knowing the people
- Literature Review papers
- Journal
- Website of ASEE – member for small charge
- Informaworld
- AAEE
- Regional groups
- COP websites

Lisbon, 2011
Challenges in writing / literature work?

- Context squared
- Time
- EER as a sideline
- Conf v Journal competition
- Overlap of fields challenge – negotiate successfully
- Objectives definition – needs to be clear
- Appropriate and helpful ethics process in institutions

- Get enough quantitative data for results
- Select the right methodology to suit your work
- Good structure
- Conference limitations
- Lack of standards in a growing field
- Skewed standards to match experience
- Language

Lisbon, 2011
Why is this important?

- We need to share otherwise ...
- Raise the bar
- Cross-disciplinary working
- Find solutions e.g. ‘mentors across borders’
- Send a more coherent message
Sources

- Journals (EER and Practice / Pedagogical Research and Practice) [Journal of Engineering Education](#)
- Conferences
- Reports (Government / Industry)
- Project websites (e.g. EUGENE, National HE STEM) [National Higher Education STEM Programme](#)
- cleerhub
Advancing global capacity for engineering education research: relating research to practice, policy and industry

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(Received 16 February 2009; final version received 2 January 2010)

Findings are presented from a series of moderated interactive sessions held at international engineering education conferences between July 2007 and December 2008, where attendees discussed the current state and future trajectory of engineering education research. More specifically, this study examines how session attendees described: (1) the relationship between engineering education research and educational practice, policy considerations and industry; (2) important stakeholders, mechanisms/strategies and challenges for relating research to practice, policy and industry. Thematic analysis and open coding procedures were used to analyse the data collected at each session. In summary, frequent discussion and widespread consensus was observed about the need to relate engineering education research to the practice of engineering teaching. Discussions about relating research to policy and industry remain formative, but appear to be gaining traction. The paper concludes by proposing a cyclic model to better conceptualise how engineering education research can be strategically related to practice, profession and industry across diverse local and global contexts.
Networks and Collaboration

- A way to extend your knowledge and experience in the field
Where can I look?

- **SEFI**
- **Nordic Network**
- **EER SIG** (HEA in UK)
- **ASEE** (Educational Research and Methods)
- **AAEE** (ERM via Wiki)
- **CREE**
- **iNEER**
- **REEN**
- Individual universities / projects e.g. Aston, Aalborg, Purdue, ECUST, Melbourne …
- **EUGENE** (FLORENS – next bid)
The UK Example

- National network – UK SIG supported by HEA
  - 40+ individuals
  - Website
  - Meetings
  - Recognition!

Aims of the SIG

- to develop an effective Engineering Education Research community in the UK promoting rigorous EER.
- identification and engagement of members of the engineering education research community both UK and internationally,
- to identify shared areas of research interest for colleagues,
- to identify funding opportunities and promote collaboration,
- to identify professional development needs and opportunities.
Conferences

- SEFI Annual Conference
- Engineering Education in UK (next in September 2012)
- ASEE – Annual Conference (June), Frontiers in Education (September), Global Colloquium (October)
- AAEE Annual Conference (December)
- ICEE / ICEER
- CREE / SEESA
- REES (Madrid in September 2011, next in 2013)
- ECUST (Shanghai, October 2009), ISPBL (UK, November 2011), Malaysia (June 2010), ALE (Copenhagen, June 2012) …
- Don’t forget the more generic LTR conferences – HERDSA, ISSOTL, SRHE (UK) …
- Consider conferences related to science and maths education
- Websites will guide you to other smaller regional meetings
What and How?

- Everything and all ways!
- Attracting young people (and keeping them)
- Active Learning
- Technology in Learning
- Competencies
- Employability
- ..... 

- Action Research / Exploratory work
- Mixed methods
- Longitudinal
Our Hypothesis:
Synergy + Variety + Relationships = Student Success

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<th>Synergy</th>
<th>Variety</th>
<th>Relationships</th>
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<tr>
<td>• What Do Engineers Do?</td>
<td>• CDIO Evaluation Project</td>
<td>• Before university – Engaging Future Engineers Project</td>
</tr>
<tr>
<td>• MSc Professional Engineering</td>
<td>• Heritage in Engineering Education</td>
<td>• Transition – Peer Mentoring Project</td>
</tr>
<tr>
<td>• Why Don’t Graduate Engineers Enter the Profession?</td>
<td>• Teaching Sustainability to Engineers</td>
<td>• At university – Active Learning</td>
</tr>
<tr>
<td>• UK, European and Global Networks – HEA, SEFI, REEN</td>
<td>• Using Technology in Engineering</td>
<td>• Beyond university – STEM Outreach and Industry / Academia Relationships</td>
</tr>
</tbody>
</table>
Some thoughts

- Don’t be shy in reaching out
- People will likely be pleased and often willing to help
- It will likely open doors to more up to date knowledge and resources
- People have preferences, hence sub-communities exist
- EER on the increase
- Be clear – what is it you want to show and how will you do this?
- Early days, momentum is building
Funding

- Collaboration adds an additional dimension
- International component
- Become a project partner
- Offer / share data
- Offer / share instruments
To conclude

- Teaching is a privilege
- Contribute to development of effective global citizens of the future
- S + V + R = Environment for Success
- Passion
- Reflection
- The best teachers need time
- The stakes are high
- Embrace change – be creative, take risks, have fun
To Conclude

- As teachers you are doing something important
- Be passionate, challenge yourself and your students
- Learn to change and you will change the learning

- Good luck!!

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