Big Issues for EER & Importance of Research

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IfM MANAGEMENT TECHNOLOGY POLICY

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Personal Perspective

- 20 years Engineering and Manufacturing Management
- 20 year teaching using PjBL
- IET HE Accreditor – 50+ accreditation visits
- Engineering Council Trustee
  - *Chair Quality Assurance Committee*
  - *International Advisory Panel*
  - *UK Spec Revision Working Party*
  - *Washington Accord Working Party*

Recent (ish) convert to Engineering Education

Opportunities for Sharing Understanding

- Current State of Engineering Education
- Strengths and Weaknesses
- Alternative Models
- Defining Engineering and Engineers
- Learning from Practice
- Future Challenges for Educators
- Problems of Change

Current State of Engineering Education

- **Increased Harmonisation**
  - IEA Accords and Bologna/EURACE Framework
- **Common Paradigms**
  - Engineering seen as technical problem solving
  - Knowledge base of engineering science – delivered hierarchically
  - Key skills of analysis and modelling
  - Application tested through capstone project work
  - Limited demonstration of transferable skills
- **Accreditation discourages Innovation?**

Strengths and Weaknesses

- **Strengths**
  - Engineers are contributing to technological advancement that provides a better living for a greater number of people
  - Global frameworks provide consistency for an increasingly international engineering industry.

- **Weaknesses**
  - Employers still criticise transferable skills
  - Discipline domain poor match to first career step
  - Pedagogic methods restrict intellectual growth
  - Depth and breadth inadequate for first post
  - Limited transferable skills development in HE
  - Analytical approach restricts the recruitment of bright students.

Weaknesses - Advanced Knowledge Acquisition

Requires:

Avoidance of Oversimplification and Overregularisation

Multiple Representations

Conceptual Knowledge as Knowledge in Use

Schema Assembly (from Rigidity to Flexibility

Non-compartmentalisation of Concepts and Cases

Active participation

Cognitive Flexibility Theory – Spiro, Coulson, Feltovitch & Anderson

Alternative Models

- Problem/Project based learning
- CDIO
- Stanford d.school
- Olin College
- MOOC/Distance Education

Defining Engineering and Engineers

- Expansion from technical to technical/business/social
- Shift from Mode 1 to Mode 2 knowledge
- Divergence between system integrators and deep domain experts
- Blurring of hierarchical levels

Learning in Practice

- Communities of Practice
- Study of multidisciplinary design engineers
- Study of non-degree educated engineers

Future Challenges for Educators

- Working within existing frameworks
- Emphasizing the progressive nature of developing engineering competence
- From transmitting to finding and assessing knowledge
- Focusing on project learning rather than project outcomes
- Balancing depth with systems thinking, particularly socio-technical systems
- Promoting the attractiveness of the profession and removing unnecessary barriers to entry

Problems of Change

- No compelling platform for change
- Institutional Resistance
- Culture of students
- Lack of convincing justification for new approaches

For the engineering community to advance passionate enthusiasm is not enough.

We need evidence gathered by well funded professional researchers!