A threshold for the understanding of structural engineering

Presentation to ACED
25th October 2013

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Update on the Institution’s project on:

‘Transforming undergraduate undergraduate education in the twenty-first century’
Content

• Introduction
• Brief summary of project background
• Work packages
• Conclusions
• Relationship with JBM
Background to project

• Deterioration in level of understanding of structural behaviour in current graduates
  – QUSB tests – David Brohn
  – Arup Foundation Report – Ian May
  – Senior members of profession - Engineering Practice Committee

• Recognition of changing environment for undergraduates
  – A levels as a preparation for engineering
  – More crowded syllabus
  – Students are different!
  – Increasing role of Computers
  – Etc

• A duty of care to improve the situation
Eleven components of overall project
(Reported in January 2011 issue of The Structural Engineer)

• Desired Learning Outcomes
• Web forum for academics
• Student forum
• Guidance on good teaching practice
• Innovative technical content
  – Content from academics
  – Third party professional material
  – Commissioned material
Eleven components of overall project - II

- Essential knowledge texts
- Award schemes for educational excellence
- ‘Training the trainer’ workshops
- Promotion of RAE secondments
- Greater branch engagement
- Facilitating academic membership of Institution
Modus operandi

• Supportive
• Collaborative
• Innovative
• Pluralist
Desired Learning Outcomes

• The ‘what’ and ‘why’ of educational content
• Initially developed by 2009 and 2010 Academic Conferences
• Subject to detailed review by Steering Committee - with wide range of opinions!
• Reduced emphasis on; traditional methods of analysis and matrix algebra
• Increased emphasis on: behaviour, qualitative analysis and analytical process
• Two levels of content: ‘Essential’ and ‘Desirable’
• Framework for future review
• Available on Academics’ Community
Academics Community

• Launched March 2012
• Vehicle for all project outputs
• Available to all academics through Institution web site www.istructe.org, with email registration
• Simple meta date schema for content.
Student forum

- In preparation
- Open access
- Focus on formative assessment
Guidance on good teaching practice

• Summaries of earlier Workshops
• Promotion of seminal texts:
  – Teaching Engineering – all you need to know about engineering education but were afraid to ask. *Peter Goodhew September 2010*  
    www.core.materials.ac.uk
  – Student engagement techniques – a handbook for college faculty, *Elizabeth Barkley 2010 Jossey-Bass*
Innovative technical content

- DLOs and associated discussion thread
- Award submissions
- Essential knowledge texts
- ‘Nuggets’ of good practice
- Links, with reviews, to third party material
Physical Models to help structural understanding

- Physical models shown in classroom to demonstrate concept
- Model attached to my door for students to play with (and break!)

30 minutes in the workshop!

You can feel the change in response
Coursework from Tianjian Ji, Manchester, on Structural Concepts

• Students read through the contents in the website: www.structuralconcepts.org

• Individual coursework:
  – Design/make a physical model that can demonstrate one structural concept, or
  – Identify a real example in which any one structural concept was used creatively or played an important role.

• Read through the collection of coursework submissions and vote for the best three submissions
Examples of Coursework Submission

String-reinforced ice beam

Self-supporting bridge

Elastic and plastic deformation of a paper clip

Equilibrium analysis of the structures in “Angry Bird”
Essential Knowledge Texts

- Major activity in 2013
- Concise summaries of most difficult topics from DLOs
- Electronic publications for students – via Academics’ Community
- Licensed for free use for education
- 19 authors commissioned and synopses agreed with Steering Committee
- 11 first drafts produced
- 6 edited and out for review
- 2 complete and signed off
- Target completion by February 2014
- NB These will support ‘Positivist’ teaching style
Award Scheme for Educational Excellence

- Any individual teaching structures at tertiary level
- A premier Institutional individual award
- Criteria:
  - Innovation
  - Evidence of effectiveness
  - Integration into overall learning scheme
- Award winners feted by Institution and highlighted at following Academic Conference
- All entries are posted on Academics’ Community
- Selected entries published in The Structural Engineer
- Entries now sought for February 2014, its third year.
Award entries for 2013

• Evernden, M. et al, **Engaging students with e-activities.** *University of Bath*

• D’Ayala, D. et al. **Complexity and redundancy from the studio to the outdoors. Understanding structural behaviour through design and assessment.** *University College London*

• Oliver Broadbent et al, **Creative conceptual design teaching, or – it’s not about rebar curtailment.** *University of Edinburgh and ThinkUp*

• Yiatros, S. **Bridging the gap: Inculcating students’ understanding through integrated teaching of analysis, design and construction.** *University of Cyprus.*
Workshop conclusions

- Endorsement of overall project direction
- Strong commitment to sharing effective practice
- Student participation / engagement crucial to progress
- Some excellent examples of:
  - Media Rich Resources (MRR)
  - Innovations in course design
- Subject/topic plans must be integrated, with special emphasis on assessment
- Role for formative assessment on key concepts
Promotion of RAE secondments

- Previously targeted at research activity
- Quote from 2013 RAE Call for Industrial Secondments

“.......Industrial Secondments allow the awardee to gain up to date knowledge and first-hand experience of current industry working practices, enabling them to improve the quality and industrial relevance of their teaching…….

........The scheme is open to engineers from all disciplines and provides funding to cover the salary cost of the applicant paid pro-rata against the amount of time to be spent at the industry host. Awards can be for any period up to six months full-time or a maximum of one year pro rata…….”

Closing date for this call 30th September 2013

- Ideal opportunity for academics:
  - with some practical experience to prepare for CM Examination
  - With or without practical experience to improve the quality of their teaching
- Ideal opportunity for academic departments to improve relationships with Regional Groups
Greater engagement with Regional Groups

- 300 academics mapped onto Institutional regional structure
- Exhortation to Regional Groups to get involved with all Universities in Region
- 2014 Pilot engagements with three Regional Groups
- 2014 Develop handbook for RGs and SLOs.
Facilitating chartered membership of Institution by academics

- R and D route recently modified for academics in research-intensive universities
- Modified for academics in teaching environments – still unsuitable
- Board priority to development and implement new route to full Membership for experienced ‘teaching academics’
- Assessment will be the key issue
Conclusions

• Now a robust framework of support for on-going change and improvement to tertiary education in structures

• Highlights are:
  • Academic Community
  • Annual Academic Conference
  • Desired Learning Outcomes
  • Essential Knowledge Texts
  • Award Scheme
  • Education Committee

• For the foreseeable future, the Institution is going to seriously address, and commit resources to, the tertiary education of its future members.
Relationship with JBM

- The project and its successors is providing increasing support to academics and around 50% of departments are involved.

- How can JBM best support these initiatives?
Personal perspective on how this will work at future accreditation visits

• Scenarios:
  – Good quality outcomes from a department involved in these initiatives – Excellent!
  – Good quality outcomes from a department not involved in these initiatives – How can the Institution / other academics learn from this success?
  – Poor quality outcomes from a department not involved in these initiatives - Why are they not involved?