Enhancing Industry Engagement in Engineering Degrees: our recent project and future plans

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ACDICT Meeting
7 – 8 July @014
Context, Purpose and Themes

The 2000’s Mining & Construction boom highlighted skills shortages (all levels), and led to formation of the National Resources Sector Workforce Strategy Taskforce.

They recommended that ACED should improve engagement with industry to increase retention rates and employability by:

"providing all 1\textsuperscript{st} and 2\textsuperscript{nd} year engineering students with an industry mentor”

Since this was impractical, ACED negotiated a project (2012-14) funded by the Dept of Industry with 12 engineering faculties, to produce:

1. Guidelines and Resources for (more) effective industry engagement – for ALL students (in EA accredited programs)
2. Trial “Industry-inspired” projects in course units
Starting Point – EA Accreditation requirements

• ALL accredited programs have to demonstrate “exposure to engineering practice”

• faculties/schools with accredited programs have to demonstrate advice from industry in program design and development
Exposure to Engineering Practice (EA advice)

- mandatory exposure to lectures on professional ethics/conduct
- practical experience in an engineering environment outside the teaching establishment
- use of staff with industry experience
- use of guest presenters,
- industry visits and inspections,
- an industry-based final year project,
- industry research for feasibility studies,
- study of industry policies, processes, practices and benchmarks,
- interviewing engineering professionals,
- Industry-based investigatory assignments,
- direct industry input of data and advice to problem solving, projects and evaluation tasks,
- electronic links with practising professionals
- case studies
now …

• ALL accredited programs have to demonstrate “exposure to engineering practice”

• faculties/schools with accredited programs have to demonstrate advice from industry in program design and development

• most (now ALL) engineering faculties include an industry placement in their accredited program/course regulations (increasingly for credit) – but hard to to source, with uneven experiences, and sub-optimum learning (overall)
A Research-based Model, Guidelines and Best Practice Resources

“improved industry engagement in ALL accredited programs for ALL graduates”
Research Design for the Model

**Phase 1**
- Literature review
- Forum/survey/interviews with universities
- Interviews with industry

**Phase 2**
- Student focus groups and survey
- Industry education forums
The Model of Effective Exposure to Practice (supported by literature and stakeholders)

Participation in **socio-technical activities** using **authentic** tools and representations in an inclusive culture in which engineering practice is valued. **Each year is more like real engineering practice.**

**Reflective practice** is supported by assessments linked to competency standards and including reflection on culture.

Students develop **identities** as student engineers, understanding the relevance of their programs and, prepared for transition to engineers.
Guidelines - Curriculum Themes

1. Education centred on engineering practice (including research)
2. Curriculum design incorporating students’ whole experience
3. Integration of socio-technical dimensions of practice
4. Reflective practice and development of students’ identity as engineers
### Best Practice Resources (on arneia.edu.au)

<table>
<thead>
<tr>
<th>Resource Title</th>
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<tbody>
<tr>
<td>Best Practice Guidelines for Effective Industry Engagement in Australian Engineering Degrees</td>
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<tr>
<td>Tool for Reflecting on Effective Industry Engagement in an Engineering Program</td>
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<tr>
<td>Benchmark Responses to Tool for Reflecting on Effective Industry Engagement</td>
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### Employer Resources

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<th>Resource Title</th>
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<tr>
<td>Student Engineering Induction Guide</td>
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<tr>
<td>Vacation Student Buddy Training Presentation</td>
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# Resources – University Exemplars

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<tr>
<th>Resource</th>
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<tbody>
<tr>
<td>AMC Employer Handbook</td>
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<tr>
<td>Curtin University Design Project</td>
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<tr>
<td>ECU Engagement Handbook</td>
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<tr>
<td>QUT Work Integrated Learning Unit</td>
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<td>QUT Work Integrated Learning Unit background</td>
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<tr>
<td>RMIT Student Engineering Experience Guidebook</td>
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<tr>
<td>Swinburne IBL Responsibilities</td>
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<tr>
<td>UTS Engineering Practice Program Student Guide</td>
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<td>UWA Career Mentor Link Guide</td>
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Final Report … also outlines

• commentaries by 11 university partners on how they are improving their performance in industry engagement

• new collaborative activities by ACED and EA on e-portfolio design

• new activities by EA
  – EA Connect to support placements
  – EoL (engineers on_line) to demonstrate ‘real engineering’
industry-inspired projects

seven ACED members have worked with industry to “breathe engineering reality” into the curriculum, mostly in large classes and mostly in middle curriculum years

$19,800 allocated to six universities, and $9,900 to one, for project development (often by casual staff or PhD students), against an approved budget

more than 1,000 students and more than 30 companies involved
## Industry-inspired Projects

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<tr>
<th>University</th>
<th>main contact</th>
<th>project/program situation</th>
<th>companies</th>
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</table>
| AMC/UTas   | David Harte, David Pointing | project engineering  
93 student, 3 disciplines (engineering interviews) | 16 contacts in 13 companies                   |
| Deakin     | Matthew Joordans         | power systems design, Yr 2  
100 students                                             | SPNet                                          |
| JCU        | Rabin Tadhulkar          | Eng. project m’gement, Yr 3  
80 – 90 students ++                                       | Glencore-Xstrata Copper Rockfield Technologies |
| UniSA      | Brenton Dansie et al     | power systems analysis, Yr 3  
engineering dynamics, Yr 2  
fluid dynamics, Yr 2  
42, 160, + nn students                                   | PSD                                            |
|            |                         |                                                                                           | Arrium & Materials / OneSteel                  |
| USQ        | Tony Ah Fock, et al.     | Energy audit, Yr 3  
110 students                                              | Downey Engineering                            |
| UTS        | Rob Jarman, et al        | Mechanics of solids, Yr 2  
274 students                                               | Atlantis, Sika Australia, SMEC, Geofabrics, Arup, Lend Lease |
| UWA        | Melinda Hodkeiwicz       | Risk, reliability & safety Yr 4/5  
186 students                                               | Rio Tinto Iron Ore                             |
project successes

- nine industry-inspired projects were developed
  - Power systems (2); Engineering dynamics; Fluid dynamics
  - Mechanics of solids
  - Project engineering / project management
  - Energy audit / Risk, reliability and safety (an area indentified by industry as important and generally poorly covered)

- positive student and external evaluations
  - student comments:
    - “gave very useful information about engineering practices from real and actual world to learners;
    - helped student [be] aware of what they might want to do in their future career;
    - Industry’s proximity to engineer students gave me opportunity to get vacation job;
    - Learning how the forces and mechanics problems we’re taught in class relate back to the big picture”
Industry partners were very pleased to assist, and get involved:

- Most of the projects have included guest lectures
- Some have included site visits

One (small classes) had guided interviews / electronic interaction with engineers (*not entirely unlike the mentoring idea at the start*)
challenges

• Sustaining projects when teaching staff change
• Two universities do not have permission for industry data to be shared, but the project framework to be shared
• Transferability of some projects may be limited by context and location
Concluding Remarks

• ACED agreed that having a specific small project fund ($19,800) was critical

• ACED will promote the project outcomes, Model, Tools, Guidelines, Best Practice and Industry–Inspired project concept (and materials) through workshops etc.

• ACED will work with ADTLs, AAEE and Engineers Australia and others on specific issues (eg e-portfolios that link to accreditation learning outcomes specification)

• ACED will use/develop this work in responding to recommendations by the AWPA study on Engineering Skills, June 2014, and other initiatives (OCS, UA) on work integrated learning

a summary paper is in ATSE Focus #184, pp 3-5