



Promoting engagement between industry and universities for improving engineering graduate capabilities and accelerating innovation

Improved industry engagement will enhance engineering students' learning, and their motivation for practice, transition into employment and capacity for innovation

The Vision

High quality and innovative engineering will be increasingly important to Australia's future prosperity and quality of life. Engineers will design, construct and operate safe and reliable engineered products, systems, infrastructure and services. The education of future generations of engineers, primarily in Australia's universities, will draw on the knowledge and expertise of engineers practicing in industry and the research centres that are spearheading Australia's progress to a knowledge-based and innovative nation.

The Issues

Engineers contribute to all sectors of the economy. Their work impinges on defence and security, transport, water, energy, mining and resources, finance, manufacturing, health, education, entertainment and scientific research. Engineers invariably aim to deliver outcomes that satisfy customer needs within the constraints of cost, time and resources, and with minimal adverse environmental effects. Innovation, using and developing new materials, technologies, and processes, is the lifeblood of modern engineering.

In Australia today, most engineering design, construction and operation is undertaken in the private industry sector, even if the work is commissioned by governments. Most Australian engineering companies are classified as small and medium sized businesses. In addition, there has been increasing focus and growth of research centres in important sectors of the economy. These are intended to drive innovation, and encourage, or even require, collaboration between industry, research organisations, and universities.

Engineering education in Australia has involved partnerships between the universities and employers for more than a century. The 'traditional' model of partnership, in which full-time students undertake vacation work with an engineering employer has long been endorsed by the professional body, Engineers Australia, and has been supported by many employers. But increasing student enrolments and changes to the structure of engineering industries have strained the capacity of this model of partnership.

The Challenges

Looking to the future, ACED aims to support its members to build on national and international best-practice in industry engagement, and develop new curriculum and models of engagement that will contribute strongly to the knowledge, skills and attitudes of all students. ACED desires to see engineering graduates transition rapidly into engineering (and other) roles, and contribute to their employers' missions and the community more broadly. Employers participating in student engagement schemes will value them, for improved graduate capabilities and other benefits. The engineering faculties and schools will also value these partnerships, and the successes of their graduates. The position of engineering in Australia at large will be enhanced, with reversal of the trends of declining interests in engineering study and career opportunities amongst Australian school students.

The ACED Industry Engagement Project

The recommendations in this paper are based primarily on the findings of a consultative industry-linked project undertaken by selected ACED members during 2011-14, with funding from the Australian Department of Industry. The project reference is provided at the end of this paper.

The project identified the benefits of greater collaboration between employers' organisations and the faculties, and the practical difficulties of achieving them. The potential benefits are high.

The project identified examples of good practice in Australian engineering faculties. Overall, the project established that:

"industry engagement [should be] a key element of the culture of engineering faculties and their partnerships with employers ... to support their students to progress through their programs and prepare them for their transition to engineering practice."

The project asserted that adopting this culture – including in applied research environments - would improve students' understanding of engineering concepts and science, their comprehension of socio-technical competencies, their knowledge of and attitudes towards practice, and their own identities as engineers. The corresponding curriculum would then be designed and implemented to integrate engineering practice more fully, incorporating students' whole life and learning experiences.

Employers' views on the benefits of collaboration	Employers' views on difficulties of collaboration
<ul style="list-style-type: none"> • Enhancing the organisation's brand among future engineers • Improving students understanding of working for the organisation • Prospective recruitment and opportunities to influence the capabilities of future graduates • Opportunities for professional development for staff • Appeal to the organisation's employees and personal satisfaction from teaching • Social license for the organisation 	<ul style="list-style-type: none"> • Difficulties in engaging with the university. • Perceptions that university people are out of touch with the industry and worlds of work • Time and inconvenience Involved in supervising students on placement • Industry experience is undervalued in teaching

Recommendations to Faculties

The project team directed most of its recommendations to the faculties, because their implementation is the responsibility of ACED members. The recommendations cover both human dimensions and curriculum, as summarised here. An engaged faculty will:

- F1 Establish and maintain effective industry engagement as part of faculty culture, with
 - (a) people, processes, and resources to ensure strong relationships with industry;
 - (b) structural and developmental support for academics to engage with industry;
 - (c) employment of engineers with industry experience to facilitate students' learning;
 - (d) structured and transparent industry consultation.
- F2 Use industry-based assignments in engineering degree programs.
- F3 Provide student engineers with substantial opportunities to work and learn in industry.
- F4 Provide most students with opportunities to undertake industry-based final year (capstone) projects.
- F5 Develop emulated work-integrated learning, as an example of effective industry engagement.
- F6 Encourage students to take responsibility for seeking opportunities in engineering practice.
- F7 Support and recognise industry engagement undertaken by student groups

Recommendations for Industry

The three recommendations to industry and employers represent the other side of the partnership. Establishing and maintaining principles of mutual benefit is paramount. Employing organisations should:

- I1 Provide regular and structured student engineer employment.
- I2 Provide support for their engineers to engage with engineering education.
- I3 Engineering employers should provide support for academics to experience industry.

Recommendations for Professional and Industry Peak Bodies, and Governments

Recognising the facilitative role of such bodies that were represented on the project steering committee, the project made six recommendations, updated as:

- B1 Professional and industry peak bodies, universities, student societies, and the Australasian Association for Engineering Education, should consider jointly establishing a resource centre to support students' industry engagement.
- B2 Governments, professional and industry peak bodies, and engineering faculties should consider establishing joint national or state based internship schemes.
- B3 Engineers Australia should consider developing an *e-portfolio* resource for student engineers.
- B4 Industry peak bodies should foster a culture of industry engagement with education.
- B5 Government should consider incentives for employers to support industry engagement in engineering education.
- B6 Engineers Australia's program accreditation criteria and guidelines on exposure to engineering practice should be reviewed to reflect changing employment conditions and other factors.

The way ahead

Since the conclusion of the ACED project, ACED and its members, together with external stakeholders are progressing many of the recommendations made here. This work is consistent with many of the goals of the national initiatives to include work integrated learning (WIL) in all undergraduate degrees. ACED welcomes further input and discussion to this important issues, particularly from employers and their peak bodies.

Reference

Sally Male and Robin King (2014, *Best Practice Guidelines for Effective Industry Engagement in Australian Engineering Degrees*, may be downloaded from the ACED website (www.aced.edu.au/resources)

Australian Council of Engineering Deans Inc.

The membership of ACED is a senior academic representative of each of the 35 Australian universities that provide professional engineering degrees accredited by Engineers Australia. ACED's mission is to promote and advance engineering education, research and scholarship on behalf of the Australian higher education system.

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