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National Processes to Support Continuous Improvement in Engineering Education in Australia

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Australia has a mature and diverse university-based engineering education system. In total, the engineering faculties and schools in 33 publically-funded universities graduate about 9,000 students per year in formative bachelor and master degree qualifications to commence supervised practice as professional engineers. Some of the universities also graduate about 2,000 engineering technologists and engineering technicians. Since Australia's demand for all engineering occupations exceeds supply, the universities aim to enrol and graduate as many students as can meet the required standards. These must cover the changing demands of employers and the profession, and students. These demands and needs, and directions for educational improvement and change, have been explored over the past three decades in consultative national reviews, most recently in 2007-8 [1]. The Australian findings and concerns are similar to those of other countries, including USA [2].

Australian universities are independently responsible for quality assurance of their award programs. From 2015, these will be subject to formal compliance with the national qualifications framework, as part of the new national tertiary education regulatory authority. The formative qualifications in engineering have, however, been accredited for several decades by the national professional membership-based organisation, Engineers Australia. Their accreditation process has thus set the national standards for all three formative qualifications in engineering and all the engineering schools seek accreditation.

The outcomes-based accreditation system defines sixteen 'elements of competency', covering knowledge and skills, engineering ability, and personal and professional attributes, for the formative qualifications for each of the three engineering occupations. These specifications were revised in 2009-10 as a result of the 2007-8 review. The expression of these outcomes and their elaboration with 'indicators of attainment' is intended to assist curriculum designers to ensure coverage of the required graduate attributes. The accreditation system is also intended to support innovation in curriculum design and delivery, and encourage development and adoption of evidence-based best practice.

The 2007-8 review found that nationally, the engineering education system was performing reasonably well. Examples of very good practice were evident, but there were also many areas in which improvements could be made. Then and since, problem and project-based learning have been more widely adopted, professors of engineering education have been appointed and engineering education research is being recognised. Three of the review's six broad recommendations focussed on improving the authenticity of engineering education. An authentic curriculum uses best possible pedagogy and has strong relationships with contemporary engineering practice. Authentic educators are knowledgeable of educational best-practice and contemporary engineering practice, as well as being researchers in engineering science. Many of the educational improvements being undertaken in the universities lie within this theme of increasing authenticity.

Two national bodies represent the engineering education community: the Australasian Association for Engineering Education (AAEE) for engineering educators; and the Australian Council of Engineering Deans (ACED) representing the faculty leaders. These organisations work together, and with Engineers Australia, to stimulate and support initiatives to improve engineering education, and the support the engineering educators within the universities. During 2011-12, they ran workshops on outcomes-based accreditation and curriculum design.

Since 2006, these efforts have been assisted by competitively-won funding from the national Office for Learning and Teaching (OLT) and its predecessors. The first of these funded ACED to lead the discipline review of engineering [1]. Alongside that initiative and since, engineering educators have won fellowships, projects and program grants. The fellowships have supported prominent educators to develop and disseminate work on engineering pedagogy, mentoring for outcomes-based education, and collaborative self and peer assessment. Most of the project funding has been awarded to multi-institution teams to enhance and disseminate best practice in areas such as remote-access laboratories, teaching and assessing meta-attributes, learning environments, student attrition and retention, student learning in engineering mechanics, and gender inclusivity. Discipline-wide funding has been provided to ACED to deliver short workshops on 'Improving Teaching', disseminate project outcomes, and develop a new resources portal. The limited funding available to the OLT severely limits its capacity to support any particular discipline.

In conclusion, it is argued that all the national bodies and initiatives referred to continue to be extremely valuable for focusing and supporting continuous improvement in engineering education in Australia. The main challenge is to increase the rate of improvement and adoption of best-practice in engineering education, so that students and employers are better served. The current university-wide drivers do not, in general, provide strong incentives to academic staff to invest in much professional development of their educational skills. To increase the visibility and momentum for and in educational change, a group of leaders in the engineering education community including the author, are working on the creation of a national networked centre for engineering education. ■

REFERENCES

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