

The Committee Secretary,  
Senate Education, Employment and Workplace Relations Committee,  
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Dear Secretary,

Engineers Australia's National Committee on Engineering Design (NCED) previously made a submission to the current inquiry into the shortage of engineering and related employment skills, and its impact on infrastructure development. That submission dealt basically with NCED's perceived need for a Graduate School of Engineering Design and Manufacture. This supplementary document expands upon the disturbing trends we see in the philosophy of engineering-design teaching in universities, and is one of the rationales for the proposed Graduate School.

**A SUPPLEMENTARY SUBMISSION TO THE SENATE INQUIRY INTO THE  
SHORTAGE OF ENGINEERING AND RELATED EMPLOYMENT SKILLS  
AND ITS IMPACT ON INFRASTRUCTURE DEVELOPMENT**

The NCED believes that we need to remain alert to a trend appearing at our Engineering universities. The distinction is between 'Engineering Science' and 'Engineering'. Both are important, but universities appear to be moving towards only teaching the former. Some appear to no longer even recognise the distinction because academics are employing academics, with appointment and accolades going to higher achievement in academia, i.e. more and more papers in prestigious engineering-science journals.

This move towards teaching only Engineering Science is understandable in view of cost pressures but not in the best interests of Australia, our students or Australian industry. Engineering Science requires fewer and less extensive facilities and fewer staff, can be done online, is well covered in textbooks, does not require costly 'hands on' experience, does not require an understanding of engineering skills or manufacturing processes and does not require technical communication such as sketching, line drawing or even the writing of technical specifications and instructions.

This latter 'stuff' is essential to Engineering Design, but the NCED believes this diminution of Engineering is at an even more fundamental level: a narrow focus only on international publications short changes the country's innovation system.

The NCED reiterates that we see 'Engineering Science' as the 'expansion of knowledge' and 'Engineering' as the 'application of knowledge'. The two must go hand in hand, but if the latter is not taught or not given significance, then the discipline, rigour, precision, responsibility and perhaps passion needed within our engineering profession is not introduced nor attained by our graduates. This is a real concern for the continuation and improvement of Australian innovation.

One of the recommendations from the New Zealand Ministry of Science and Innovation 2011 Power Innovation review (<http://www.msi.govt.nz/about-us/consultations-and-reviews>) was to shift the employment contract and reward structures across the university system to encourage staff to spend periods working in business and industry and vice versa. Such mobility is more common in Europe, and it is recommended that it or a similar structure be considered for implementation in Australia.

The shortage of engineering skills is not due to the actions of universities alone. We have the ongoing challenge of getting more children to hang on to maths and physics beyond Year 10 at secondary school to achieve a larger and stronger flow of students entering engineering degree programmes. To this end design-based robotics competitions and the like, and schools engagement by academics who are practical engineers, are initiatives we must continue to promote. It is the Engineering rather than the Engineering Science that will serve to motivate and inspire our children to stick with science and maths.

In summary, the NCED is convinced it is essential not only for engineering students to be taught practical engineering, but also for these students, as well as those in secondary schools, to be inspired with the idea that it is only through a combination of science and engineering that the challenge of moving to an environmentally finite world of prosperity without

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Dr Alex Churches

Chair  
The National Committee on Engineering Design  
Engineers Australia

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