



DIVERSIFYING ENGINEERING: OVERCOMING A NATIONAL SKILLS CRISIS

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Australia is facing a growing demand for engineers across a range of industries. The expanding pipeline of projects – in areas such as infrastructure, transport, mining and resources, construction, defence and beyond – means that more and more skilled engineers are needed to deliver them. Further, staying ahead of the curve in new developments such as robotics, digital technology, artificial intelligence and advanced materials will require the knowledge, innovation and know-how of trained engineers. But this burgeoning demand for labour is not being met with an adequate supply. While industries are calling out for more engineers, the number of young people completing engineering degrees at university is shrinking.

According to Engineers Australia, the nation's peak body for the engineering profession, over the past 15 years, skilled migration has become the dominant source of Australia's engineers¹. Of the new engineers entering the workforce in 2015, 9,850 were entry-level engineering graduates, while 16,000 were migrants on either temporary or permanent visas.

The decade to 2012 saw the engineering workforce expand significantly to meet the high demand for engineers during the construction phase of the resources boom and, more broadly, the need for engineers to support a rapidly growing national economy. Figures from Engineers Australia show that the number of students applying to study engineering peaked in 2013². It is now falling steadily.

A glance at the mining sector, for instance, shows the extent of the problem. During the resources boom, approximately 300 mining engineers graduated every year, according to figures from the Minerals Council of Australia³. Based on current enrolment figures, it is expected that in four years that figure will have sunk to 50 graduates.

The problem of participation

Worryingly, the problem reaches beyond university graduation rates. High school student participation in science, mathematics and technology subjects is falling. A 2017 report from Engineers Australia indicates that female participation in science and mathematics in Year 12 is alarmingly low.

The report's findings show fewer than 6 per cent of girls nationally studied physics in year 12, with advanced maths numbers almost as low – 6.2 per cent for girls and 11.5 per cent for boys. These numbers are linked to acceptances of places in engineering courses at university.

"A key issue is that in the face of falling participating in science and mathematics subjects, increasing high school retention further can stabilise the number of students in these subjects and create a window of opportunity that policy makers can take advantage of to implement new policies to reverse falling STEM participation. An important factor here is eliminating excessive differences in retention between states and territories," the Engineers Australia report states.



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“The results suggest that Australia’s capacity to develop more of its own future engineers is limited by falling participation in year 12 science and mathematics and, in the case of women, is impeded by alarmingly low participation. There is an urgent need to reverse these trends to overcome these limitations and impediments.” With numbers like these, there is little wonder that Australia is heavily reliant on engineers from overseas. To build up Australia’s homegrown engineering workforce, then, it will be necessary to encourage more high school students to study advanced and intermediate mathematics and science to year 12.

Changing Perceptions

In response to this skills shortage, the industry has recently started to take a closer look at its image and whether there might be ways of making the engineering profession more appealing, especially to young adults and teenagers. Broadening the intake is now seen as a way of overcoming the crisis. And this is requiring a change in perceptions about what an engineering career looks like in the twenty-first century.

Changing perceptions requires a change in messaging. One of the ways forward, according to Engineers Australia, is to focus more on the creativity and teamwork that is involved in engineering and the benefits that the profession brings to society. “Mathematics and science will remain necessary skills for engineering, but we need to change the messaging to appeal to younger people,” Engineers Australia’s *State of the Engineering Profession* report reads. “Let’s shift the focus away from the subjects students need to study to become engineers, and showcase examples of how engineers benefit society, improving the everyday lives of Australians by creating new innovative products for us to enjoy.”

Traditionally, engineering has been a male-dominated profession. While more women than ever are pursuing careers as engineers, the numbers are still heavily skewed.

Companies are now broadening their intake and trying to hire more female engineers. And, while there have been improvements, the statistics remain sobering. A recent report by Engineers Australia showed that women make up a mere 12.4 per cent of the engineering population. In 2017, only 17 per cent of engineering places at Australia’s universities were taken by women⁴. This is a record high, but more work remains to be done. According to Engineers Australia, while persistent workplace and cultural problems figure among the

reasons for the low numbers of women pursuing a career in engineering, a more intractable problem is the lagging participation of young women in critical foundation subjects for engineering – which contrasts significantly with overall female participation in higher education, which is 30 per cent higher than young men⁵. “In effect, this low participation has created an environment in which engineering recruits most engineers from half of the population, a situation that is unsustainable given our national ambitions,” one of the body’s recent reports states.

But the performance of young women that do take up degrees in engineering is indicative of the potential they can bring to the profession. For instance, young women who accept places have better ATAR scores than young men.



Bridging the gap

The gap between numbers of men and the number of women studying engineering courses is a deep concern of Engineers Australia, which is promoting strategies to overcome the imbalance.

“From the male-dominated courses grows a male dominated profession, which is an unsustainable situation given our national ambitions,” the *State of the Engineering Profession* report says. “We need to encourage interest in engineering-related subjects from both genders equally.”

The federal government also has been pursuing methods of encouraging more females to take up the engineering profession. In the 2018-19 federal budget, \$4.5 million was provided for initiatives that encourage more female participation in STEM, including a Decadal Plan that is to be developed by the Australian Academy of Science and the Australian Academy of Technology and Engineering. The Plan will provide a 10-year roadmap for achieving sustained increases in women’s participation and

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retention in STEM, identifying the barriers and enablers that are present in primary, secondary and tertiary (university and TAFE/VET) education, as well as all levels and stages of careers in academia, government, industry and private enterprise.

The problem of low rates of STEM participation in schools is also being addressed by policy. In December last year, for instance, a group of 64 year 9 and 10 students from across Australia began the six-month Curious Minds program, which provides specialist coaching programs, industry expert lectures, interactive sessions and field trips in the sector.

The program looks to be a success. Previous Curious Minds participants reported an increased interest, success and confidence in STEM subjects, with 70 per cent saying it helped them decide to pursue future studies in these fields, according to federal industry, science and technology minister Karen Andrews. The federal government has provided \$1.65 million for the program, which it hopes will see a doubling of the number of places in the program, thus enabling 120 girls to participate each year.

For its part, Engineers Australia has recently been working hard to reach out to young people – females in

particular. STARportal, an interactive website established in partnership with the Office of the Chief Scientist, was launched in 2017. It gives teachers, parents and students a real-time resource to find STEM activities in their local area. The body's Engineering Studies Teacher Program was also officially accredited by the NSW Education Standards Authority in 2018. The program provides teachers with resources and webinars through 90-minute sessions twice per school term to develop and improve their understanding and appreciation of the field of engineering.

While the shortage of engineers isn't going away any time soon, it is hoped that these initiatives will go some way to overturning the downward trend in engineering numbers at universities across Australia. The University of Queensland is among the institutions that have been making strides in this area, commencing its Women in Engineering (WE) program in 2013. WE is the nation's first university-led, industry-funded initiative to address the gender disparity in engineering at both the tertiary and industry levels.

According to the university, it has seen significant growth in female student numbers, with women now accounting for 23.8 per cent of commencing engineering students in 2017 – up from 18.8 per cent before 2013 and well above the current national average of 16 per cent. The program's goal is to achieve more than 30 per cent by 2023⁶.

Among the many challenges for industry is changing perceptions about what an engineering career can offer young women. In the past, a lack of obvious role models has hampering the communication of the broad range of skills and experiences that the profession offers. But this is beginning to change.

Last year, award-winning astrophysicist Professor Lisa Harvey-Smith from The University of NSW was appointed as Australia's first Women in STEM Ambassador, a role which will be dedicated to encouraging girls and women to study and work in science, technology, engineering and mathematics fields on a national scale.

“As Australia's first Women in STEM Ambassador, Professor Harvey-Smith will advocate for girls and women in STEM education and careers, raising awareness and driving cultural and social change for gender equity. I look forward to working closely with her,” minister Karen Andrews said upon the appointment. “If we can increase participation in STEM by girls and women, we will strengthen Australia's research, scientific and business capability.”



References:

[1] Engineers Australia, *Engineers Make Things Happen*, 2017.

[2] Engineers Australia, *State of the Engineering Profession: Engineering in Australia*, 2017.

[3] Minerals Tertiary Education Council, *Key Performance Measures: Report 2018*, 2018.

[4] Engineers Australia, *The Engineering Profession: A Statistical Overview*, 13th edition, February 2017.

[5] *Engineers Make Things Happen*.

[6] The University of Queensland, “Gender Diversity: are we shifting or fixing the problem” [<https://shorthand.uq.edu.au/eait/ingenuity/gender-diversity/>].