

Recommendations

The results suggest that Australia's capacity to develop more of its own future engineers is limited by falling participation in year 12 STEM subjects. Creating a more gender-balanced profession is impeded by alarmingly low STEM subject participation by girls in school.

There is an urgent need to reverse these trends because engineering is already a majority overseas born profession, and further reliance on skilled migration carries unnecessary risks for the supply of engineers.

Engineers Australia recommends a range of action be taken, with a focus on skilled migration, school education and workforce development.

Skilled migration:

- Recognise and acknowledge the risks of over-dependence on skilled migration to Australia's future engineering capacity.
- The objective and selection methodologies for permanent migration of engineers should be reconfigured to focus more closely on building future engineering capability.
- Permanent migration selection policies for engineers should be changed to focus on skills requirements in areas of emerging technology.
- Permanent visas granted to migrant engineers should include packages to help adjustment to Australian labour market conditions.
- Review inconsistencies between the objective and practice of temporary migration policies, especially with regard to the large number of engineers employed on 457 visas despite the absence of a widespread skills shortage.
- Include mandatory skills assessments for temporary work visas.

School education:

- Encourage more students to study advanced and intermediate maths and science to year 12 to build the necessary technical educational foundation for Australia's innovation revolution.
- The development of more specialist maths and science teachers.
- Encourage more young women to participate in school-level advanced and intermediate maths and science.

Workforce development:

- Implement policies that encourage more Australians to undertake and complete engineering courses.
- Implement policies and programs to retain competent experienced engineers in the profession.
- Use innovation policies to recognise and highlight the critical role of engineers in turning ideas into products and services with social, economic and environmental value.
- Implement policies and programs to ensure sufficient competent, practising engineers to realise opportunities created by the inventiveness of Australians.
- Align policies and programs that foster innovation with the educational requirements and professional development necessary to become an engineer.
- Recognise the costs to society and innovation policy associated with low retention of qualified engineers in engineering work, and find ways to improve retention, especially for women and migrants.
- Recognise the importance of continual technological progress and commit to long term and stable innovation policies and programs.

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Engineers Make Things Happen

The need for an engineering pipeline strategy

Summary Report

Ambition

Practically every good and service consumed or used in production embodies engineering. Innovative ideas are the beginning of technological advance, but it is engineers who turn ideas into practical and commercially valuable reality. The difficulties of some STEM graduates in finding full employment shows that economic development policies still have a long way to go.

“Australia ranks poorly in global innovation indices”

Australia's engineering capability is indispensable for achieving the ambition of becoming an innovative and globally competitive nation. Given the ambition, Australia ranks poorly in global innovation indices and the report shows that Australia needs to do more to build its engineering capability.

A global search for talent

During the early years of the resources boom, Australia produced fewer engineers each year. This trend changed in about 2006 but, because of the long duration of engineering education, graduate numbers did not increase until the resources boom was almost over.

Permanent migration of engineers has been higher than domestic student university completions since 2009. Temporary skilled migration has increased and fallen broadly in line with the intent of policy. Together, permanent and temporary migration accounts for almost two-thirds of our new engineers.

Source of new engineers in 2015



Australia's ranking on the World Economic Forum innovation index



“Australia is excessively dependent on skilled migration.”

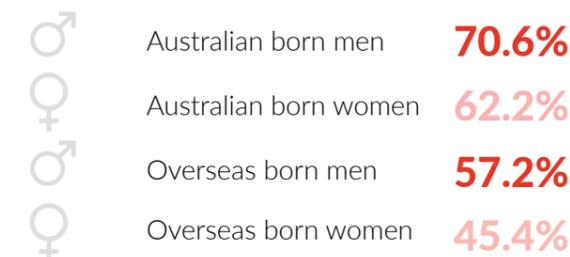
Australia is therefore excessively dependent on skilled migration. This has meant that engineering is predominantly comprised of overseas born engineers, which is in stark contrast to other professions.

Population born overseas



Continuation of this reliance is not risk free: Australia's skilled migration program does not contribute to building our engineering capability efficiently because selection emphasises entry level qualifications but does not assess capacity to practice engineering. This leads to overseas-born engineers being less likely than Australian-born peers to work in engineering-related roles.

Qualified engineers working in engineering roles



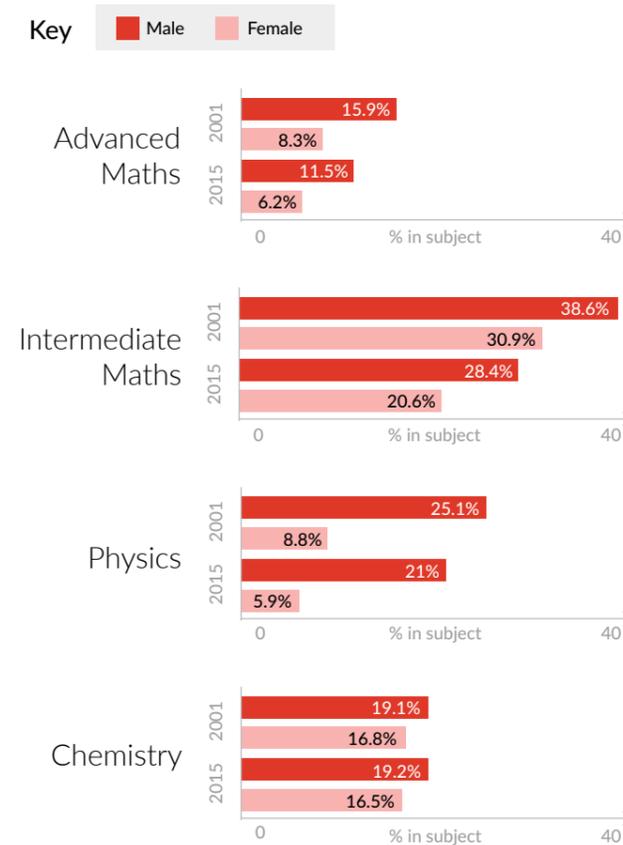
The STEM gap

Adjustment to the post-mining boom era has been facilitated by the retirement of many older engineers and the adaptability of others. When the adjustment is complete, we will have sufficient engineers to sustain a low-growth Australian economy.

If Australia is to become an innovative nation, our engineering capability must expand. This should be done by reducing reliance on skilled migration and producing a greater number of home-grown engineers.

Mathematics and science are the tools used by engineers to solve real world problems. For engineering, participation in high school STEM subjects is a vital means to an end—but there is a looming crisis in STEM participation.

The percentage of students studying STEM is still dropping

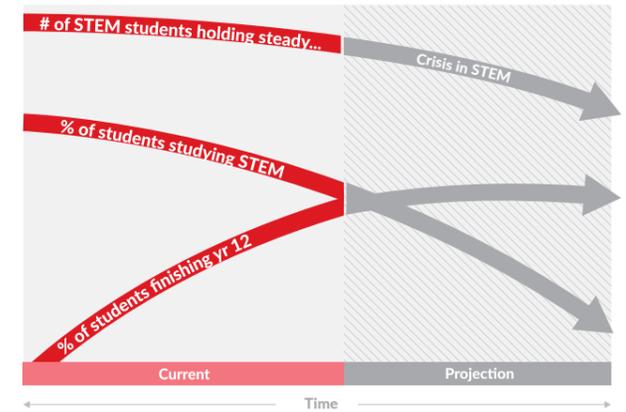


Until now, the falling rates have been offset by improvements in high school student retention overall. This counterweight has had the effect of stabilising raw numbers of STEM students, but retention gains will soon stop. The window of opportunity to reform STEM in schools is closing.

Student retention to year 12



A looming crisis in STEM



Degrees of difficulty in attracting STEM students to engineering

The 'degree of difficulty' is a measure of the percentage of high school STEM students who universities must recruit to maintain current engineering student intake (see Table 1).

For example, the fewer students studying maths at school, the higher the degree of difficulty for universities to recruit sufficient numbers of high school graduates with maths skills.

The table shows a direct connection between the low numbers of women in engineering and severe degrees of difficulty in attracting young women with required year 12 advanced mathematics and physics backgrounds.

The study of year 12 STEM subjects is the means to build Australia's future engineering profession, not an end in itself.

Table 1: Degrees of difficulty in attracting STEM students to engineering

SUBJECT	Young Men	Young Women	Cohort
Advanced Mathematics	MODERATE	SEVERE	HIGH
Intermediate Mathematics	LOW	MODERATE	LOW
Physics	LOW	SEVERE	MODERATE
Chemistry	MODERATE	MODERATE	MODERATE

Gender profile of the profession

