



Increasing women's participation
in engineering education:
Actions for change

Introduction

Engineering should be as diverse as the people it serves. For all Australian workplaces, diversity is good for culture and outcomes. Businesses thrive with a mix of ideas and views from people with different backgrounds and experiences.

The engineering industry should value diversity to an even greater extent, because problem solving is fundamental to engineering. Diversity yields better solutions, new ideas, and stronger financial performance.

And yet, engineering hasn't achieved the gender equity realised in other industries. To achieve this goal, more women must be attracted to university engineering education.

Women make up 47% of all employed people in Australia. In engineering, they make up 12% of the workforce and 16% of students studying at universities.

Employed people
in Australia

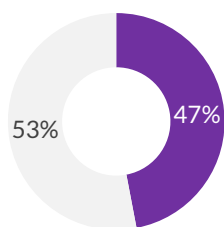


Figure 1.1

Australian engineering
workforce

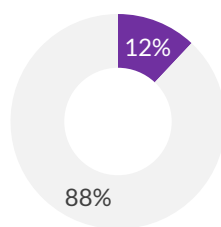


Figure 1.2

Students studying engineering
at university

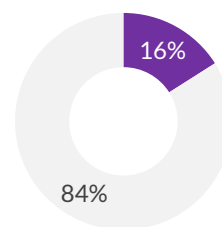


Figure 1.3

Diversity in engineering education is a national issue needing urgent attention.

Women in engineering

If we want more women to choose higher education in engineering, we need more girls to engage with engineering. But many girls aren't invited to consider engineering as a career.

Addressing this issue means building positive early ideas of what it means to be an engineer. This starts in early childhood education and primary school.

'Ensuring girls and women have equal access to STEM education and ultimately STEM careers is an imperative from the human rights, scientific, and development perspectives.' – UNESCO, 2017.

In May 2019, the Engineering for Australia Taskforce came together and identified issues that contribute to the low participation of women in engineering:

- Engineering enrolments don't reflect the diversity of the Australian population, particularly gender diversity.
- Engineering isn't visible enough in schools (and in society generally).
- There are many outreach and engagement programs and initiatives, but they operate in isolation, don't scale and aren't well evaluated.

Teachers, early educators and school leaders are at the core for addressing these nationwide problems. Industry and government efforts must help these early influencers to grow girls' interest in engineering.

Professor Deborah Corrigan and Dr Kathleen Aikens prepared a report for the Taskforce to assess the current barriers, [Barriers to Participation in Engineering and the Value of Interventions to Improve Diversity](#).

This plan supports women specifically in engineering higher education, recognising that the challenges in engineering are more pronounced than the rest of the STEM workforce. The [Women in STEM Decadal Plan](#) from the Australian Academy of Science and Australian Academy of Technology and Engineering has practical actions for all sectors to support a strong STEM workforce to 2030.

Engineering identity

Girls consider their skills and abilities early. They work out whether they feel confident in science and any maths – the foundations of engineering – at a time when they're building views on gender. This results in girls streaming out of the pre-requisites for choosing engineering in senior high school and university.

The stereotype is that engineering (and other STEM fields) is mainly for boys. Girls can feel anxious about their performance, thinking 'boys do better at this than me'. The experience with engineering becomes negative, and how they feel about it is negative too. They believe it's difficult, not interesting, and not an attractive career.

Creating a positive engineering identity at a young age is central to fostering girls' interest in the field.

We must explore ways to help them develop a positive identity and see how this connects to a future in engineering.

Criteria for success

Australia needs an evidence-based, nationwide strategy with sustained impact focused on developing an engineering identity starting from primary school.

We're calling on all sectors to take actions that support teachers and early educators to build the engineering identity.

Help girls to know they can succeed as an engineer. All actions must meet the criteria set by the Engineering for Australia Taskforce. That is to:

- influence young peoples' choices to study engineering, particularly women and girls
- encourage national, system-wide solutions.

Early childhood educators, teachers, school leaders and families are critical to:

- promoting the engineering identity
- keeping girls connected to the idea of becoming an engineer.

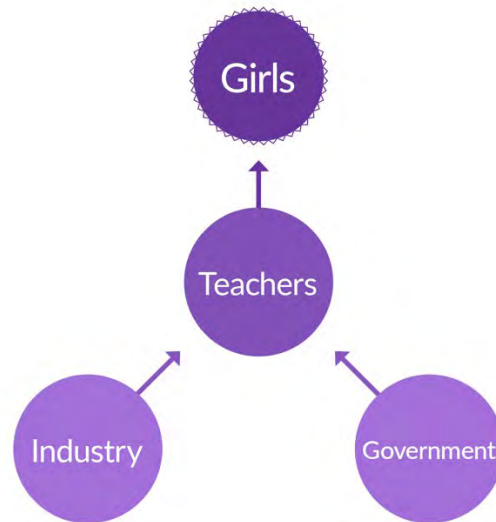
The broader policy and program environment must evolve to support these influencers. That means there are actions to take right now for:

- educators and learning environments
- industry
- government.

It's also important for parents, carers and family members to become engineering champions. That means changing the way they think and talk about girls and engineering. Schools, industry and government should consider them an important audience for their actions.

Actions for change

Teachers are in direct contact with girls, so they have a leading role to play.



Primary school teachers and early childhood educators

There is a critical window in early childhood education, as girls form their identity and ideas about what they're capable of. Teachers must capture girls' interest in engineering and nurture it.

Action 1. Teachers participate in professional development to improve engineering knowledge, skills and confidence.

To show girls that engineering is open to them, teachers and early childhood educators must:

- understand engineering essentials
- encourage girls who show an interest.

Girls in STEM classrooms are often asked fewer questions and given less talking time.

Teachers can reach this understanding through supported training and self-directed learning. They will recognise and promote engineering as part of teaching the existing curriculum.

Action 2. Teach engineering as a distinct learning area, not just as a part of maths and science.

There are many STEM initiatives and activities, but few address engineering as distinct from science, technology and maths. Engineering content is included in the curriculum, but the word 'engineering' isn't used.

As a result, teachers and students covering engineering content don't associate what they're doing as 'engineering'. Girls might not realise they have aptitude in this field, and that these skills create opportunities for a rewarding career.

Action 3. Use inclusive language, learning environments and tools.

'Research on biological factors, including brain structure and development, genetics, neuroscience and hormones, shows that the gender gap in STEM is not the result of sex differences in these factors or in innate ability.' - UNESCO, 2017

Children's attitudes and ideas about engineering are developing at the same time as ideas about gender, in the early school years. Teachers should explore ways to make engineering feel equally accessible to all genders, including through:

- encouraging girls to participate equally in engineering, maths and science lessons and discussions
- promoting women as role models in engineering, maths and science, to show children what's possible
- creating learning environments around engineering where girls can feel a sense of belonging.

Industry

Industry can support teachers and early educators to promote engineering as a desirable career choice.

By getting involved in the early years with programs and activities, industry can promote a positive engineering identity and benefit from better participation of women in the workforce.

Action 1. Champion the need for diversity in the engineering workforce and campaign for change.

Encouraging girls into engineering education and workplaces can't happen without showing the places that are waiting for them are welcoming and inclusive. Industry has a role to make sure the engineering culture:

- is inclusive and respectful
- challenges traditional stereotypes
- is free from discrimination and bias
- enables flexibility and accommodates career interruptions and changes.

Action 2. Give financial and in-kind support to programs that fit the criteria prioritised by the Taskforce.

For the biggest impact while considering spend, industry must prioritise:

- existing programs with credible evidence of impact achieved to date
- new programs that include clearly defined evaluation criteria in the design.

Industry should partner together to support programs for primary-aged students that are long term, nationally scalable and engineering focused.

Action 3. Take part in outreach activities with a broad spectrum of students, use inclusive language and challenge outdated gender stereotypes.

Students from rural and regional areas are already under-represented in STEM careers, due to a lack of opportunity for equal education. Travel restrictions during COVID-19 caused further division and highlighted the need for program accessibility.

All students in Australia should be able to access activities to increase the diversity of students choosing engineering. Otherwise, existing inequality could be reinforced.

Government

Teachers who have quality information, training and resources can teach engineering concepts and explore what engineering careers look like to their students. Funding practical support for schools and teachers will help them to do this.

Action 1. Only fund initiatives with evidence of impact or which have evaluation criteria included in the design.

There are many gender equality initiatives for STEM, but many lack the evaluation of their outcomes. It's important to only consider evidence-based approaches and make evaluation and continuous improvement a condition of funding to ensure they're effective.

For the biggest impact while considering spend, government must prioritise:

- existing programs with credible evidence of impact achieved to date
- new programs that include clearly defined evaluation criteria in the design.

Government should support programs for primary-aged students that are long term, nationally scalable and engineering focused.

Action 2. Ensure programs are funded to allow sufficient time for benefits to be fully realised.

Research shows that programs which are sustained tend to have greater impact than one-off interventions. Students experience one-off interventions as separate to their core learning, and so, are perceived as less relevant.¹



¹Professor Deborah Corrigan and Dr Kathleen Aikens, "Barriers to participation in engineering and the value of interventions to improve diversity", Monash Education Futures.

Resources

- [Women in STEM Decadal Plan](#)
- [The Australian Government's STEM Equity Monitor](#)
- [Women in STEM Ambassador's Future You](#)
- [The Girls in STEM Toolkit](#)
- [Women in STEM Ambassador's National Evaluation Guide for STEM Gender Equity Programs](#)
- [Questacon's Engineering is Elementary](#)
- [CSIRO's STEM Professionals in Schools](#)
- [CSER's MOOC programs for educators](#)
- [Robogals incursions and competition](#)

Find more resources on the [Engineers Australia's website](#).

The Engineering for Australia Taskforce

The [Engineering for Australia Taskforce](#) is a group dedicated to increasing women's participation in engineering in Australia.

Members

Jane MacMaster – Chief Engineer, Engineer Australia (Chair)

Elizabeth Croft – Dean of Engineering, Monash University (Deputy Chair)

Lisa Harvey-Smith – Australian Government Women in STEM Ambassador, UNSW

Katrina Falkner – Dean of Engineering, Adelaide University

Sally-Ann Williams – CEO, Cicada Innovations

Paul Wood – Board Member, ATSE

The Taskforce first met in 2019 to discuss their concerns for diversity in engineering education. The Taskforce commissioned Monash Education Futures to identify ways to [mitigate the barriers preventing women from choosing to study engineering](#).

Now, the group is working through the report's recommendations so they can fulfil their goal to have more women studying engineering university degrees in Australia.

They encourage actions based on the potential to influence young people's choices to study engineering.



Please get in touch

If you've got a question or want more information,
contact diversity@engineersaustralia.org.au