

Advancing STEM education

Enhanced commitment to school STEM education is vital for Australia's prosperity

Action Now

- » More teaching time on STEM subjects
- » STEM qualification for STEM teachers
- » Better STEM teacher education
- » Hands-on enquiry-based learning for STEM

Skills for a competitive and prosperous Australia

Sustainable wealth creation now and in the future will be driven by science and technology. Improved quality and reach of science, technology, engineering and mathematics (STEM) education and ongoing skills development for an innovative, knowledge-based workforce are vital for Australia's prosperity, for its capacity to meet national challenges, and for its global competitiveness.

Demand for STEM skills in Australia is clear – 75 per cent of the fastest growing occupations require significant STEM skills and knowledge. STEM-based employment is projected to grow at almost twice the pace of other occupations. Yet currently 41 per cent of employers are having difficulty recruiting STEM-skilled technicians and 26 per cent struggle to recruit STEM-skilled professionals and managers. These skills shortages will increase if no action is taken.

The vision

1. Enhanced fundamental STEM teaching in primary schools to capture the imagination of students and to inspire their interest to continue STEM subjects through to secondary and beyond.
2. A national secondary school science, mathematics, and technology curriculum delivered to a greater proportion of school students, by STEM-qualified teachers with access to ongoing professional development linked to career progression.
3. Enhanced learning experiences in the school and tertiary STEM curriculum that include experimental and practical learning that develop STEM-based problem solving, and critical thinking in all students.
4. STEM-based tertiary graduates with workplace skills (including entrepreneurship, project management, research translation and critical thinking) better able to meet the needs of technology-intensive industries in Australia, and who engage in continuous development of these skills through further informal and formal study.

The challenge

There is a need to ensure a sufficient supply of STEM graduates and employees who are needed by Australia's existing and emerging industries. STEM skills and the analytical capabilities that they instil, such as critical thinking, organisational skills, innovative problem solving, and the development and implementation of new ideas, are critical to many occupations – not just traditional STEM industry sectors.

Typically, there is minimal time spent on teaching science in primary school and this has severe effects on the scientific literacy and numeracy levels of the community – where only half of the community is able to cope with the mathematics requirements for daily life.

Students are presented with a wide range of offerings in secondary school and in many schools there is little encouragement provided to undertake STEM subjects. Many students perceive STEM as boring and difficult and therefore often opt for subjects they are confident in and that will assist in gaining a higher university entrance score. A desire to study science demands qualified science teachers who can create interest through their personal confidence in the material they teach.

In recent times, many tertiary programs have dropped STEM prerequisites even for STEM-related courses and professional pathways. This has acted as a further disincentive for students to study STEM subjects in senior school years and has contributed to the decline in the numbers of teachers appointed with STEM qualifications.

Australia must ensure that more time is spent on teaching science, mathematics and technology in schools and that more teachers are adequately trained in these areas. Tertiary institutions must produce more STEM graduates who are better able to meet the demands of an innovative and increasingly high-tech economy.

To raise the level of STEM skills in Australia, more effective policies and much stronger initiatives to support STEM in schools and universities will be needed. A recent Australian Council of Learned Academies report mapped out some key benchmark objectives for Australia, which the Academy endorses:

- » A national timetable for elimination of out-of-field teaching in STEM in Australia, coupled with monitoring of graduates from teacher training and rigorous discipline-specific professional development training programs, linked to monetary incentives and leading to a qualification, for teachers currently teaching out-of-field in science and maths.

- » Engage secondary school-level science and mathematics teachers in sustained discipline specific professional development programs, focussed on pedagogical content knowledge and content knowledge that are not part of generic professional development programs common to all teachers.

Recommendations

The Academy calls for the following priority set of actions:

Recommendation 1

Governments should commit to increasing the amount of time spent teaching quality STEM subjects in our schools.

- » Maintain or expand our national frameworks and standards for STEM school education.
- » Inspire the interest of students, by using multidisciplinary, authentic topics in curriculum units supplied to teachers.
- » Require that at least one STEM subject be taken by all students through to Year 12.
- » Reintroduce more comprehensive prerequisite requirements for entry to university programs requiring advanced STEM knowledge.

Recommendation 2

Governments should commit to eliminating of out-of-field teaching in STEM in Australian secondary schools.

- » All future secondary STEM teachers should be required to hold at least a Bachelor's degree in a relevant STEM field: this change must be led by governments.
- » Compulsory ongoing professional development should be an in-service requirement. Such programs should be established through collaborations between science, engineering and education faculties within universities.
- » While applauding the new funding reforms to secure equitable student access to quality education, these increased funds should also be conditional on reforms in teaching and learning practices for Australia's education system.
- » Teacher promotion should be based on continuous participation in measured, annual professional development training and demonstration of best practice and leadership in STEM education.
- » Incentives should be provided for STEM graduates and professionals to study for an education qualification in order to teach STEM subjects.

Recommendation 3

Universities must improve secondary science and technology teacher education and provide broader attribute training in undergraduate and post-graduate STEM courses across Australia.

- » Improvements in teacher education should be seen as the joint responsibility of education and STEM faculties within universities.
- » Broader STEM courses should provide extra- disciplinary training in graduate attributes such as entrepreneurship, project management, research translation and critical thinking, in addition to established professional standards and requirements.