STEM in Queensland schools

Why STEM education benefits students and society

Introduction

STEM education refers collectively to the teaching of Science, Technology, Engineering and Mathematics disciplines. The National STEM school education strategy 2016–2026 (Education Council, 2015) aims to improve STEM education by lifting foundational skills in STEM learning areas, developing mathematical, scientific and technological literacy, and promoting 21st century skills such as problem-solving, critical analysis and creative thinking. The Australian Curriculum supports STEM learning initiatives through the Science, Technologies and Mathematics learning areas and through the general capabilities.

STEM literacy involves the use of foundational knowledge and skills from STEM learning areas, through a problem-based or inquiry approach, to create solutions. It may involve:

- identifying issues and problems

- posing questions

- providing explanations

- drawing evidence-based conclusions

- creating solutions.

STEM capabilities are the ways of thinking about STEM issues and problems.
They may include:

- deep knowledge of a subject

- creativity

- problem-solving

- critical thinking

- communication skills.[1]

Teachers have the opportunity to promote students' curiosity about STEM from the early years to Year 12 by integrating STEM education into their learning programs.

Why STEM education is important

STEM is part of everyday life and an increasing part of every workplace. STEM education enables students to develop solutions to complex problems and provides them with literacies and capabilities that will help them succeed in a world of technological change. As future innovators, educators, researchers and leaders, it is important that students develop the skills required to compete on a global scale.

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[1]Australia's Chief Scientist 2014, *Science, technology, engineering and mathematics: Australia's future*, www.chiefscientist.gov.au/2014/09/professor-chubb-releases-science-technology-engineering-and-mathematics-australias-future.

How STEM education benefits students

STEM education benefits students by providing them with:

- a deeper understanding of the STEM disciplines

- skills to be competitive in the workplace. There is a growing gap between high-demand occupations and the skills required to fill them in fields like information technology

- 21st century skills, e.g. collaboration, critical thinking, creativity and problem-solving

- STEM literacy for everyday use

- knowledge and confidence to learn.

Why schools should invest in STEM education

STEM affects the economy

While Australia has experienced a period of sustained economic growth, some evidence suggests that this growth may be slowing. Government and business sectors have indicated an urgent need for a greater focus on STEM education in Australia if the country is to remain competitive.

International research shows that building STEM capacity supports innovation, productivity and competitiveness. STEM capacity drives the generation of new ideas and solutions to societal challenges and shapes new industries and companies. PricewaterhouseCoopers has estimated that moving 1% of Australia's workforce into STEM-related roles would add $57.4 billion to GDP.[2]

Future employment trends

The Australian Bureau of Statistics (ABS) has estimated that STEM-related jobs in professional, scientific and technical services will increase by 12.5% over the next five years, with employment in the computer system design and related services sector projected to increase by 24.6%.[3] School leavers need to be encouraged to enter STEM-related fields if these jobs are to be filled by skilled employees.

It's what employers want

Technological advances have changed the way work is done. Employers' demands for STEM skills are increasing, and they want a future workforce that is STEM-literate and STEM-capable.

A STEM-literate and STEM-capable individual engages with issues and problems in a constructive, concerned and reflective way. This is relevant to a wide range of occupations and will be important skills for an adaptable, nimble workforce.

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[2] PricewaterhouseCoopers 2015, *A smart move: Future-proofing Australia's workforce by growing skills in science, technology, engineering and maths*, www.pwc.com.au/stem.html.

[3] Labour Market Information Portal 2017, *2017 Industry employment projections report*, http://lmip.gov.au/default.aspx?LMIP/EmploymentProjections.

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How schools can support STEM education

Schools can help students develop STEM literacy and STEM capability by promoting STEM learning in their curriculum planning and teaching approaches. This includes:

- promoting the importance of STEM education to students and parents
- preparing students to become part of a skilled STEM workforce.

This will in turn provide a foundation for lifelong STEM literacy in the community.

The Australian STEM strategy

The *National STEM school education strategy 2016–2026* identifies two goals for Australian schools:

1. Ensure all students finish school with strong foundational knowledge in STEM and related skills.
2. Ensure that students are inspired to take on more challenging STEM subjects.

The strategy proposes actions for schools to support these goals, including:

- increasing student STEM ability, engagement, participation and aspiration
- increasing teacher capacity and STEM teaching quality
- supporting STEM education opportunities within school systems
- facilitating effective partnerships with tertiary education providers, business and industry
- building a strong evidence base.

The Queensland STEM strategy

The Queensland Government released the following reports in response to the *National STEM School Education Strategy 2016–2026*:

- Advancing education: An action plan for education in Queensland (revised 2017)
- Engaging Queenslanders in Science strategy (2016).

These reports suggest actions to support STEM learning, including:

- increasing student engagement through STEM strategies by implementing the Digital Technologies curriculum and STEM academies, and by targeting under-represented groups
- transforming the teaching of STEM through enhancing and supporting teacher preparation and capability, and providing access to mentors
- encouraging students' entrepreneurship by improving links between schools and industry.

How STEM education can be incorporated into learning plans

Integrative and/or collaborative STEM education provides an opportunity for teachers to introduce K–12 students to STEM concepts that provide them with critical skills for the future and that may lead them to pursuing STEM careers.

Where STEM education is included in Australian Curriculum learning areas

STEM knowledge, understanding and skills are included in the Australian Curriculum learning areas of Science, Mathematics and Technologies. While Engineering is not a distinct Australian Curriculum learning area, engineering processes and skills can be found in Science, Mathematics and Technologies. In Technologies, specific engineering content is included through the Engineering principles and systems learning context and the Processes and production skills strand in the Design and Technologies and Digital Technologies subjects.

How the general capabilities align to STEM education

The Australian Curriculum general capabilities represent the broader aims of the Australian Curriculum and are transferrable skills specifically identified in all learning areas. The following general capabilities align to STEM education:

- literacy
- numeracy
- personal and social capability
- ethical understanding
- intercultural understanding
- information and communication technology (ICT) capability
- critical and creative thinking.

While the pedagogical approach to teaching the Australian Curriculum is the domain of state education authorities, teachers may integrate STEM knowledge, understanding and skills into learning plans through an interdisciplinary approach. This enriches student learning by creating a deeper understanding of STEM, and gives students the ability to transfer skills across disciplines to find innovative solutions to issues and problems.

How to make STEM education relevant

When delivered using an interdisciplinary approach, STEM education can enhance STEM literacy and capability, and increase student engagement in STEM disciplines. This can be achieved by:

- creating authentic, age-appropriate learning contexts to teach STEM knowledge, understanding and skills
- ensuring learning contexts connect to a range of environments, including school, community, work and the global marketplace
- developing contexts that provide equal access for all students.