STEM for Australia
Science | Technology | Engineering | Mathematics

3P Learning
What is STEM?

STEM education is an interdisciplinary approach to learning which integrates the study of science, technology, engineering and mathematics into a cohesive learning paradigm. Rather than teaching the four disciplines as completely separate and discrete subjects, STEM offers an integrated approach where students are challenged to draw connections between their learning and the real-world.

STEM focuses on these areas together not only because the skills and knowledge in each discipline are essential for student success, but also because these fields are deeply intertwined in the real world and in how students learn most effectively. The underlying purpose of STEM education is therefore to equip students with critical thinking, problem solving, creativity and communication skills, necessary for future success in a wide range of occupations.

On a global scale, efforts to encourage students to take up STEM subjects have been on the rise in recent years. However, Australian enrolments in almost every STEM subject area have continued to fall over the last decade. Strong performance in STEM is critical to future economic growth, encouraging curiosity and reflection in the students of today will ensure we come closer to closing the STEM skills gap in Australia.

The importance of STEM for individuals

The fields of science, technology, engineering and mathematics are deeply intertwined in our everyday lives, covering everything from the mechanics and reasons behind daily functioning to the complexities of modern technologies. Through STEM education individuals are given the opportunity to access a wealth of knowledge and information which contributes towards their understanding of the world they live in.

However, importantly, STEM education also creates critical thinkers through instilling a sense of intrigue in individuals. As such, STEM education allows young minds to challenge their world, understand new concepts, make well-informed decisions and pursue new interests – effectively enabling the next generation of innovators.

75% of the fastest growing occupations now require STEM skills and knowledge.
The importance of STEM education

Australia has been a major contributor in innovation and entrepreneurship on a global scale, with continued excellence in science, technology, engineering and mathematics. However, recent studies have highlighted worrying gaps in Australia’s STEM skills pipeline and a declining national interest in STEM in general. So what does this really mean?

If Australia is to maintain its strong economy and competitive position, it must make science, technology, engineering and mathematics a priority. STEM education creates the pipeline of future innovations, which is the key to continued growth and reducing Australia’s economic reliance on natural resources.

STEM skills are more important than ever, with many jobs today requiring at least basic levels STEM knowledge. The career and further study options of students with this level of understanding are far greater than students with little or no STEM knowledge. An ABS study found that STEM-related occupations grew at one-and-a-half times the rate of other occupations between 2006 and 2011. With industries like advanced manufacturing, life sciences, clean energy and health care expanding at a rapid pace, STEM education is a critical element in ensuring students are prepared for the jobs of tomorrow.

The Australian Government is investing approximately 9 billion dollars into science, research and innovation, in an attempt to lift our national performance in STEM areas.

“There will be significant emphasis in boosting our focus on science, technology, engineering and maths because science is at the heart of a country’s competitiveness and it is important that we do not neglect science as we look at the general educational and training schemes.”

Prime Minister of Australia, the Hon Tony Abbott MP (June 2014)
In recent years, politicians, the media and high-profile scientists have given a lot of attention to declining enrolments in Science and Mathematics courses at both the secondary and university levels, which have reached the lowest levels in 20 years. Government and industry representatives have identified school education as a key contributor to the STEM skills gap and there is a worrying shortfall of qualified teachers in the field. A recent study of Australian enrolment trends has detailed the continuing decline of Science and Mathematics enrolments in Australian high schools.

In an effort to improve academic performance and increase interest in all areas of STEM, it is imperative that educators improve STEM literacy levels in schools. This effort has been identified as a key solution to bridging the gap between job demand and eligible STEM applicants in years to come.

<table>
<thead>
<tr>
<th>Course</th>
<th>Enrolment Change</th>
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<tbody>
<tr>
<td>Chemistry</td>
<td>-5%</td>
</tr>
<tr>
<td>Physics</td>
<td>-7%</td>
</tr>
<tr>
<td>Multidisciplinary Science</td>
<td>-5%</td>
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<tr>
<td>Intermediate Mathematics</td>
<td>-11%</td>
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<tr>
<td>Advanced Mathematics</td>
<td>-7%</td>
</tr>
<tr>
<td>Biology</td>
<td>-10%</td>
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How can we create a STEM-literate student body?

Fostering engagement in STEM depends on two things: inspiring teaching and inspiring resources. Not only to convey complex principles but to instil a lasting passion for STEM in students.

Creating a STEM-literate student body starts with providing students with the appropriate STEM know-WHAT and know-HOW to equip them with the skills to succeed. The question lies in how this can be effectively executed?

Providing students with STEM know-WHAT

STEM fields are inherently difficult and challenging for students, therefore the first step is to provide students with the resources to encourage and facilitate understanding in STEM.

To do so, teachers must engage students in learning environments which facilitate the acquisition of essential skills and knowledge. The challenging factor in this process is designing educational programs which address the individual learning needs of each student. This refers to the provision of suitable STEM learning resources and the delivery of instructional strategies to empower individual students to reach their academic potential and, importantly, develop a interest in STEM.

THE SOLUTION?

The implementation of innovative, instructional teaching and learning strategies has been identified as a key motivator to encouraging excellence and interest in STEM. With technology ingrained in STEM education, online learning environments provide an ideal platform to this achieve STEM objective through:

1. Providing students with rich multi-media learning resources (lessons, assessments & feedback) to foster true understanding
2. Supporting student achievement through the development of individualised learning pathways
3. Promoting student interest through engaging interfaces and interactive activities

The resources embedded in online learning environments are revolutionising STEM education and, importantly, facilitating students’ STEM know-WHAT through widening the scope of learning materials available.
Providing students with STEM know-HOW

At the core of all successful STEM endeavours lies the ability to investigate, analyse and importantly, inquire into existing and new phenomenon. With these skills unique to STEM fields, creating a STEM-literate student body depends upon students acquiring this valuable skill set.

THE SOLUTION?

Education bodies are emphasising the importance of practicing inquiry-based learning (IBL) strategies to ensure students develop essential STEM skills during school. Through focusing on the process rather than the outcome, these learning strategies help to increase intellectual engagement and foster deeper understanding through challenging students to understand the reason behind their learning.

With class sizes increasing, this student centric learning approach can be challenging to implement in a traditional classroom setting. However fortunately, new educational technologies are providing teachers with the tools to facilitate inquiry-based learning and encourage active learning in the classroom. Online learning technologies provide students with a unique opportunity to develop essential inquiry, analytical and reasoning skills through access to:

- Rich multi-media information sources.
- Interactive individual & group activities and
- 3D exploratory environments.

Through adopting a blended learning approach and integrating educational technologies into classroom practices, teachers can ensure that their students develop the essential STEM know-HOW to excel in the future.

To discover how your school can improve its STEM program, speak to our education specialists

Phone: 1300 850 331 | Email: customerservice@3plearning.com.au
Government Initiatives

National level case studies:

Restoring the focus on STEM in schools initiative

The Australian Government has committed an extra $12 million to increase student enrolment of science, technology, engineering and mathematics subjects and restore the focus on STEM at both primary and secondary levels across the country. Restoring the focus on STEM subjects is about ensuring Australian students are equipped with the skills necessary for the jobs of the future.

The initiative will provide funding for four key elements:

• Providing innovative mathematics curriculum resources for primary and secondary school students, focusing on inquiry-led teaching.

• Supporting the introduction of computer coding across different year levels in Australian schools leading to greater exposure to computational thinking, with the ultimate goal of expanding the pool of ICT-skilled workers.

• An innovative approach to education based on the United States ‘Pathways in Technology Early College High School’ (P-TECH) model.

• Summer schools for STEM students, to increase the number of girls and disadvantaged students attending — including Indigenous students and those from regional and remote areas.


PrimaryConnections

PrimaryConnections: Linking science with literacy is an innovative program run by the Australian Academy of Science and supported by the Australian Government. The program aims to increase primary school teachers’ competence for teaching science, while supporting students with the key strands of the Mathematics and English curricula and developing skills in both science and literacy.

PrimaryConnections key features:

• An inquiry and investigative approach

• A comprehensive professional learning program

• Award winning curriculum resources linking science with literacy

• An ongoing research and evaluation program

Source: [www.primaryconnections.org.au](http://www.primaryconnections.org.au)
State level case study:

Investing in science: An action plan for prosperity through science, research and innovation

One example of Australian states taking individual responsibility for their economic future is South Australia’s Investing In Science initiative. A total of around $170 million in funding a year is provided from a number of revenue sources to support actions outlined in the initiative.

The South Australian Investing In Science initiative incorporates seven key pillars to boost interest and participation in STEM:

1. Investing in people, our current and future research leaders
2. Investing in STEM skills to drive innovation and growth
3. Investing in research to build on our strengths
4. Industry collaboration, entrepreneurship and commercialisation
5. Building strategic international partnerships
6. Increasing wellbeing through publicly funded research
7. Investing in strategic infrastructure


Private Initiatives

Business leaders are relying on excellent STEM education to develop the next generation of collaborative problem-solvers. Businesses across Australia and the rest of the world are experiencing the impact of the “STEM skills gap”, which is seeing a lack of qualified graduates in the fields of science, technology, engineering and mathematics.

Forward thinking business associations and not-for-profit organisations are seeking to address the skills gap by introducing STEM programs to encourage and inspire upper-primary and secondary school students to engage in STEM endeavours. One example of this is the ACER Foundation who ran the first Australian STEM Video Game Challenge in 2014.

Case Study:

Australian STEM Video Game Challenge

The Australian STEM Video Game Challenge is an initiative run by the ACER Foundation, an independent, not-for-profit organisation. The challenge encourages upper-primary and secondary students to develop skills in science, technology, engineering and mathematics by designing a functioning video game. Participants are increasingly engaged with STEM areas and also develop creativity, problem solving, critical-thinking and communication skills. The challenge also aims to encourage students that are from groups typically underrepresented in STEM in Australia, such as girls and students from disadvantaged backgrounds, in an attempt to narrow the diversity gap.
Addressing gender diversity in STEM

Building diversity in STEM professions continues to be a global issue, with women significantly underrepresented in the fields of science, technology, engineering and mathematics.
The reasons underpinning this issue range from a lack of female role models, to gender stereotyping and less family-friendly flexibility in STEM fields. However, regardless of the reason, Australia has realised that it cannot afford to lose half of its potential innovative minds and should be encouraging women into STEM fields in order to continue to be a global leader in innovation.

Over the years Australian women have been at the forefront of many important discoveries and innovations in the STEM fields, such as the revolutionary spray-on skin for treating burns victims, developed by Dr. Fiona Wood. However, the number of innovations by Australian women is still dramatically lower than that of their male counterparts. This poses the question, if more women were encouraged to be actively involved in STEM fields how much higher could our national potential be?

The solution? Encouraging women in STEM must begin at an early age, whether that be at home or importantly, in the classroom. In order to change the current gender stereotypes, women must find inspiration from other women and realise their potential to contribute towards global innovation.

A history of women in STEM

Despite a long history of gender inequality in STEM fields, women have contributed to and continue to contribute to many of the greatest global STEM developments. From programmers of the world’s first electronic computer to space archaeologists and Higgs Boson physicists, women continue to make their mark in history. Take a look at some of the remarkable achievements of women over time...

Lise Meitner
Lise Meitner was the second woman to receive a Ph.D. in Physics from the University of Vienna. She discovered that uranium atoms were split when bombarded with neutrons, which eventually led to the atomic bomb.

Rosalind Franklin
Rosalind Franklin was a biophysicist and X-ray crystallographer who played a key role in developing our modern understanding of the molecular structures of DNA, RNA, viruses, coal and graphite.
A history of women in STEM (cont.)

Kathleen “Kay” McNulty
Kay McNulty was one of the six original programmers of the ENIAC, the first general-purpose electronic digital computer. Kay accepted her job as a “computer” in 1942 at a starting annual salary of $1,620, and three years later she was selected to be one of its first programmers.

Dr. Sarah Parcak
Sarah Parcak is a space archaeologist who uses satellites, initially designed for use by the military, to identify potential sub-surface remains. “When people initially think of the term space archaeologist they think ‘oh it’s someone who uses satellites to look for alien settlements on Mars or in outer space’ but the opposite is true— we’re actually looking for evidence of past human life on planet earth,” she says.

Dr. Fiona Wood
Dr. Fiona Wood is a well-known plastic surgeon, most recognised for her patented invention of spray-on skin for burns victims. This innovation famously contributed to the largest proportion of survivors from the 2002 Bali bombings. Dr. Wood and her team worked to save 28 patients suffering from between 2% and 92% body burns and deadly infections. She was named a Member of the Order of Australia in 2003 and Australian of the Year in 2005 by Australian Prime Minister John Howard.

Fabiola Gianotti
Fabiola is the coordinator for the world’s biggest science experiment, occupying one of the top jobs in science as a Higgs Boson physicist.

“‘This job is a great scientific adventure. But it’s also a great human adventure.”

Marissa Mayer
CEO of Yahoo, former engineer at Google.

“There is such a stereotype of the hacker; the pasty-skinned guy with the thick glasses, the pocket protector, the blue glow coming off of the monitor ... people think if they’re going to be good at this, that’s what they need to be. You can be good at technology and like fashion and art. You can be good at technology and be a jock. You can be good at technology and be a mom. You can do it your way, on your terms.”
As educators, we realise our responsibility to re-engage students in the marvels of science, technology, engineering and mathematics. Our educational philosophy is founded on the importance of encouraging enthusiasm and excellence in students – and our online resources aspire to do exactly that.

Our mathematics resource, Mathletics, is a multi-award winning learning resource that encourages students and rewards results. Fully aligned to the Australian Curriculum, Mathletics combines high quality mathematics content, adaptive technology and engaging learning environments to encourage students to experience and make sense of mathematics. With comprehensive reports providing teachers with powerful diagnostic information, improving student engagement and achievement in mathematics has never been easier.

Our science resource, IntoScience, is committed to educating students, accommodating teachers and inspiring a love of science in all. Through hugely engaging 3D environments, virtual experiments and deep contextual examples, IntoScience brings all fields of science to life. Developed on an enquiry-based model, IntoScience works to expand students learning through knowledge, application and reasoning – challenging students to recognise the important role that science plays in their lives.

We are dedicated to changing the global landscape of STEM education, and the engaging and interactive nature of our products is helping us to do that. Science, technology, engineering and mathematics are fantastic and fundamental parts of education, and together we can help students uncover that.