



Australia's STEM Education Challenges

Discussion Paper



October 2019

About us



Consult Australia is the industry association that represents the business interests of consulting firms who provide design, advisory and engineering services for the built and natural environment. We represent an industry comprising some 48,000 firms across Australia, ranging from sole practitioners through to some of Australia's top 500 firms with combined revenue exceeding \$40 billion a year.

Some of our member firms include:



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Scope and purpose

This discussion paper is the first of three in a thought leadership series on the importance of STEM education and the STEM talent pipeline for Australia's future.

The thought leadership series aims to outline why a strong supply of STEM skills is needed to maintain our position in the world as an advanced, innovative, and services-based economy – all of which are underpinned by the performance of STEM education in Australia.

The focus of this first discussion paper is on Australia's current STEM education challenges. It analyses Australia's current STEM education performance relating to quality, uptake, and the diversity of its cohort. It reviews the current approach of Australian governments to improve STEM education outcomes, and the range of related industry and education sector initiatives in place, and analyses trends for consideration in the second and third discussion papers.

The primary aim of this paper is to start a conversation on how governments, industry and the education sector can work together to build a robust STEM talent pipeline. Consult Australia will discuss findings with stakeholders with the view to developing practical recommendations on improving STEM education outcomes, and to better understand how STEM education can align to skills demands of the future workforce – the focus areas of the second and third discussion paper.



Executive summary

Consult Australia's member firms are supporting the delivery of an exciting and growing long-term pipeline of infrastructure and other built environment projects across Australia. These projects will help change the face of our country by creating more vibrant places and enabling communities to thrive, maximising new technologies to improve how our cities are connected, and growing the economy while maintaining high living standards. However, this ambitious long-term pipeline of new projects is dependent on having a workforce with the right capabilities and capacity to deliver it.

As is the case for a number of STEM-related fields, the infrastructure and built environment workforce is currently stretched and experiencing skill shortages in areas such as civil and structural engineering. Our workforce's ability to respond to demands of tomorrow cannot be assumed, nor can we simply increase capabilities and capacity overnight – particularly when considering the broader demand for STEM skills across all areas of the economy.

Many crucial STEM-related occupations require years of professional experience and training, and are underpinned by our education system. Therefore, any response to meeting significant increases in demand for STEM skills in Australia must start with our education performance in these fields, and a commitment to strengthen Australia's STEM talent pipeline.

When we compare our current STEM education performance to international counterparts, Australia looks to be falling behind. We are not achieving the same upswing in STEM education participation and standards as other countries. Instead, our domestic performance appears to be going backwards over recent decades which is creating what the Australian Industry Group¹ describe as a growing 'knowledge generated' gap where the number of students developing STEM skills through the education system is not meeting growing demands from industry.

A key challenge facing STEM education in Australia is participation rates. Many STEM subjects, particularly in secondary schools, are experiencing declining participation rates in areas such as advanced mathematics and science. Poor participation rates in these schooling years are reversing some recent improvements in participation and engagement during primary school years, and are also resulting in poor attrition rates for related STEM university courses.

Declining participation rates are also exacerbated by a chronic ongoing gender imbalance with women and girls underrepresented in many STEM education fields. A gender imbalance in STEM education participation rates is one cause (amongst many) why only 12 per cent of Australia's engineering workforce are women. Women and girls currently face a number of barriers to participating in STEM education, such as gendered views on education choices and disengagement due to content being perceived as not inclusive or relevant. Many of these factors can be linked to broader cultural perceptions in Australia where there are engrained views across society on gender and career paths.

A number of international performance measures also highlight that Australia's STEM education standards have declined over recent decades. This decline has been described by the Australian Council for Education Research as a '20-year slide' when performance results are compared with countries such as the United States and the United Kingdom. Curriculum that is not covering the right content, and struggles to incorporate 'learning progression' in particular areas due to the breadth of STEM fields, have been linked to this decline in standards, in addition to an under-supply of teachers with STEM qualifications. Industry's experience reflects these findings with 49 per cent of Consult Australia's member firms indicating that many graduates are not job-ready with the practical and technical skills required when joining the workforce.

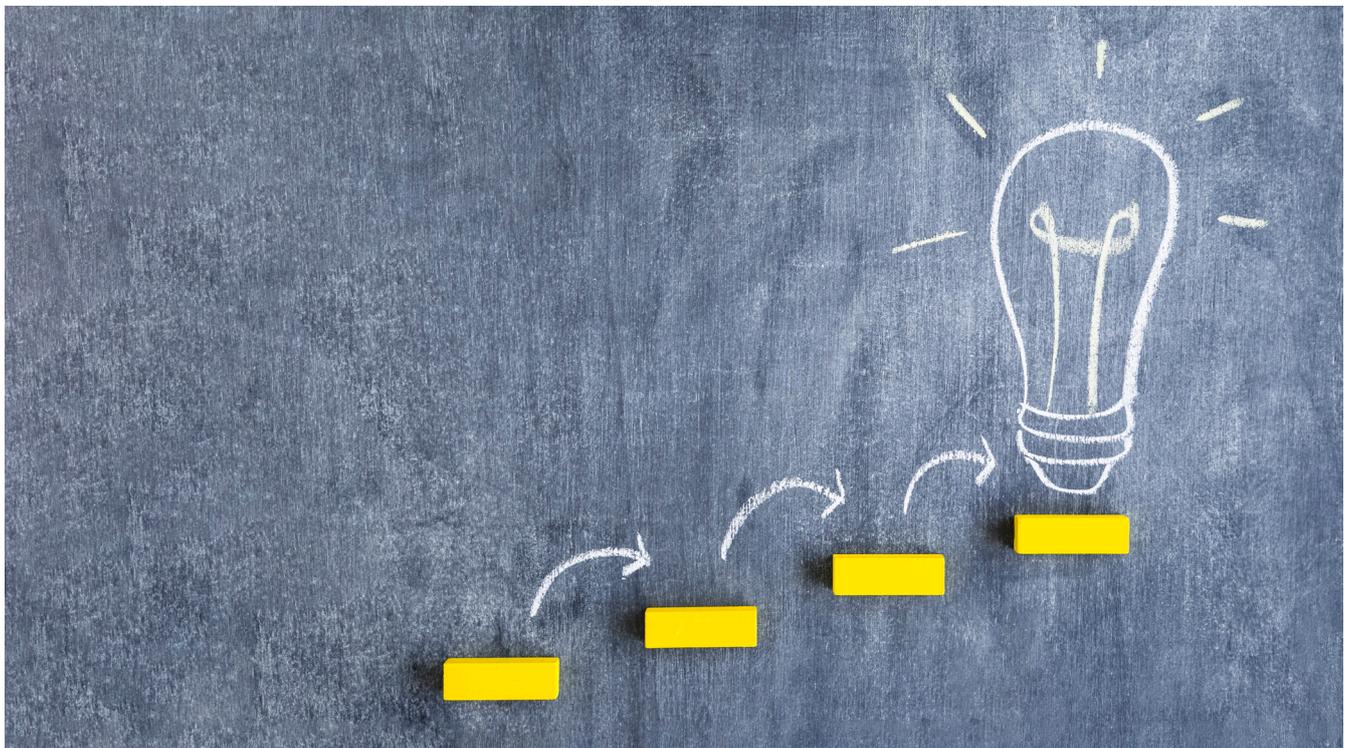
The need to improve Australia's STEM education performance has been recognised over recent years by governments. Scattered responsibilities between levels of governments has resulted in scattered approaches to improving STEM education performance. While there have been attempts to provide consistency through the Council of Australian Governments (COAG) and a national strategy, its implementation has reverted back to being scattered and inconsistent.

¹ Australian Industry Group, [Progressing STEM skills in Australia \(2015\)](#)

In addition to the efforts of governments, the education sector and industry have designed and delivered a number of their own initiatives aimed at improving STEM education outcomes and promoting related STEM careers. These initiatives have a mixture of focus areas and approaches, such as a focus on gender diversity, targeting lower socioeconomic areas and different age groups, and providing additional support to high performing students. While some have a whole-of-STEM focus, some specifically aim to promote education, skills and careers in particular areas such as engineering or technology. While most of these provide examples of impactful education sector and industry-led initiatives, as highlighted by case studies in this discussion paper, a challenge remains that they are targeted in nature and unable to have a broader reach across the community.

Consult Australia sees an opportunity to strengthen Australia's STEM talent pipeline by improving collaboration between governments, industry and the education sector, and re-focusing on a coordinated approach to improving Australia's STEM education performance. The growing STEM skills gap facing industry and the education sector has not and will not be addressed through one stakeholder alone. Instead, we are far more likely to meet Australia's current and future demands for STEM skills by taking a partnership approach to identifying and responding to STEM education challenges.

This discussion paper concludes by outlining Consult Australia's desire to engage with stakeholders in governments, the education sector, and industry to discuss STEM education challenges and the current approach to improving outcomes. These engagements will be followed by the development of a second discussion paper on how STEM education can respond to industry's future workforce demands, and a final discussion paper outlining recommendations for a more effective and longer-term solution to meeting Australia's current and future demand for STEM skills.



Background photo created by freepik

Australia's current STEM education performance

Background

STEM skills cannot be viewed as only being relevant to one aspect of Australia's economy. STEM skills are instead becoming core competencies for most sectors and job types, such as the ability to analyse data and interact with digital technology². The rapid technology advances and integrations driving this change also means that competition for critical STEM skills will only increase from non-traditional players and we will continue to see Australia's STEM talent pipeline being stretched to meet these demands.

Around the world, other countries have identified STEM skills as a key tool for long-term economic growth and global competitiveness. Nowhere is this clearer than in China and India, where both countries are seeing significant booms in STEM education performance over recent years and are now outperforming Western counterparts. The World Economic Forum highlights how producing more university graduates with STEM qualifications has been viewed by these countries as 'vital cogs' for their future prosperity, producing 7.3 million graduates in related fields in 2016 alone³.

Australia in comparison looks to be falling behind other countries by not achieving a similar upswing in STEM education participation and performance, and at the same time is not capitalising on the STEM skills available on the global market. As a result, Australia runs the risk of squeezing its STEM-related workforce at both ends and may not be in a position to meet future demands for STEM skills.

This section seeks to summarise challenges relating to Australia's current STEM education performance from an industry perspective and based on current demands for STEM skills.

Declining participation rates

Industry is currently experiencing a STEM skill shortage that appears to be driven by declining STEM education participation rates and a significant increase in demand for STEM skills across the Australian economy. The Australian Industry Group describe poor participation rates in STEM education as creating a 'knowledge generated' gap⁴ where the pipeline of students developing STEM skills through the education system is not meeting demands. Australia's Chief Scientist also found that 45 per cent of employers expect their requirements for STEM-related professionals will increase over the next five to ten years, with 32 per cent already having difficulties recruiting for these roles⁵.

Findings on STEM skill shortages across industry also reflect the experience of many firms providing design, advisory and engineering services for the built environment. Consult Australia's 2019 skills survey found that 63 per cent of respondents are experiencing a skill shortage, with many disciplines related to engineering most affected. Furthermore, 60 per cent of respondents indicated their firm as having difficulties recruiting graduates with an insufficient number of graduates in specialist areas cited as a reason⁶.

While there are a number of examples of positive engagement and high performance with STEM education throughout Australia, particularly in early schooling years, research and industry's experience is suggesting there is an overall drop in participation rates at Australian schools. Australia's Chief Scientist, Alan Finkel, has been a leading voice on these concerns, particularly at secondary schools where they are prevalent. For example, participation in most Year 12 mathematics and science subjects have declined, with only one in 10 students completing advanced mathematics, and participation in science subjects being the lowest in 20 years⁷.

2 Productivity Commission, [Shifting the dial: five-year productivity review \(2017\)](#)

3 World Economic Forum, [The Human Capital Report \(2016\)](#)

4 Australian Industry Group, [Progressing STEM skills in Australia \(2015\)](#)

5 Australian Chief Scientist, [STEM skills in the workplace \(2015\)](#)

6 Consult Australia, 2019 Skills Survey Results

7 Australian Chief Scientist, [Science and maths in Australian secondary schools \(2017\)](#)

This decline in STEM education participation rates in Australian secondary schools is also impacting participation and completion rates at universities for many STEM fields. For example, applications for engineering places in 2017 through Tertiary Admission Centres (TACs) have declined 16.2 per cent since 2013, and acceptances through TACs and direct applications have fallen by around 20 per cent over the past two years⁸. Completion rates for entry-level engineering degrees also highlights a gap when compared to those enrolled, even when factoring in lower enrolment figures in earlier years, as outlined below.

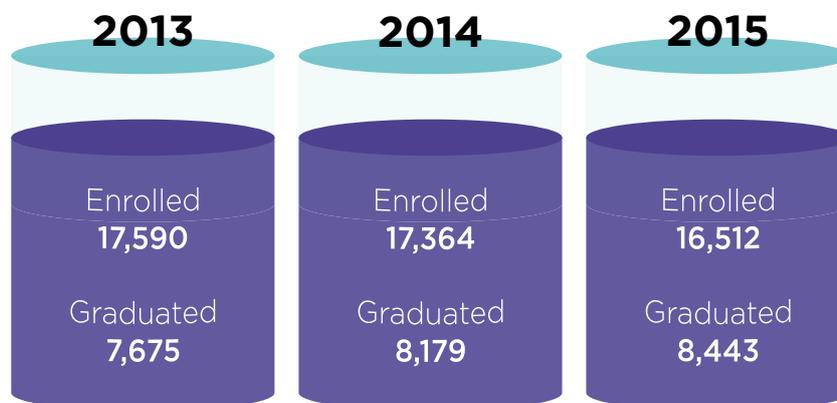


Table 1: Domestic Student Entry Engineering Course Commencement vs Graduation 2013-2015⁹

Potential causes

A potential cause for declining participation rates is that many STEM fields may not be sufficiently showcased to students. This is likely impacting engagement in foundational years when STEM education is a compulsory part of the curriculum and poor participation rates in later years when STEM education becomes optional. Showcasing STEM fields can include exposure to role models and experts, providing insights on what STEM-related careers actually entail, introducing concepts such as engineering solutions and engineering design, and providing a better learning experience through resources and facilities to support hands-on materials¹⁰.

Another cause for declining STEM participation rates may be school career adviser knowledge gaps on career opportunities and the tendency to focus on subject selections based on potential ATAR (Australian Tertiary Admission Rank) results. A Victorian inquiry on the topic highlighted that school career advisers are often unaware of all career opportunities available within industries and how the nature of work is changing, and this is limiting their ability to provide the best guidance to students. The inquiry noted that the tendency for career advisers to focus on ATAR results is perpetuated by schools and the broader community¹¹. This reflects the findings of a national survey of 7000 school leavers in 2017 where 55 per cent believed their schools cared more about ATAR results than student pathways¹².

Poor attrition rates for STEM-related university courses has been linked to a steep learning curve at this level. This creates a ‘sink or swim’ environment, particularly for students without appropriate foundational skills. A lack of interactive teaching methods has been described as another cause, which can result in poor grades in the mostly technical and abstract subjects in the early years of STEM-related courses. It has also been suggested there is a broader issue at play where students are both being “pushed out” by poor grades in STEM-related courses and “pulled away” by opportunities for higher grades in other courses¹³.

Lastly, it is important to note that potential causes relating to declining STEM education standards are also likely factors that crossover to impact declining participation rates. These relate to the learning experience, including teaching standards and the design of curriculum, and is discussed further later in this section.

⁸ Engineers Australia, [Higher education: applications, offers and acceptances \(2018\)](#)

⁹ Engineers Australia, [Status of the Engineering Profession Report \(2017\)](#)

¹⁰ The Conversation, [STEM education in primary schools will fall flat unless issues are addressed \(2017\)](#)

¹¹ Parliament of Victoria, [Inquiry into career advice activities in Victorian schools \(2018\)](#)

¹² Year13, [After the ATAR \(2017\)](#)

¹³ The New York Times, [Why Science Major Change Their Minds \(2011\)](#)

Gender imbalance

As is widely reported, many STEM-related professions in Australia face chronic gender imbalance issues with their workforce. For example, 12 per cent of Australia’s engineering workforce are women which compares to 35 per cent across Europe¹⁴. There are clear public perceptions engrained across society about gender and career paths, which impacts on why many women and girls do not consider STEM career paths. This is particularly the case in the infrastructure, built environment and construction sectors where female representation in these fields has not improved over the past two decades¹⁵.

Consult Australia’s 2019 skills survey results echo these industry and community wide views. Female engineers and related professionals make up less than 20 per cent of the workforce for over two-thirds of firms in our industry. While it is positive that 53 per cent of firms are focused on increasing the gender diversity of their workforce, a broader challenge is the gender diversity of the STEM talent pipeline with 50 per cent of firms indicating there is an insufficient number of female graduates in the market¹⁶.

The education system’s experience looks to closely align to industry where Australia is losing female students at every level of STEM education despite no innate gender differences¹⁷. Gender bias and stereotyping is a significant factor which impacts the participation and engagement of females in STEM education and this begins at an early age. The confidence of female students has also been flagged as a key factor. Some key statistics identified by the Australian Chief Scientist relating to bias, engagement and confidence include:

- Two thirds of children aged nine to eleven draw a man when asked to draw a scientist;
- 66 per cent of female students in Grade 4 reported not being confident in their mathematics abilities (compared to 38 per cent of males) despite having similar average performances in NAPLAN numeracy results; and
- 33 per cent of 15-year-old females did not think mathematics would help them with later study and 24 per cent with getting a job (compared to 20 per cent and 16 per cent with 15-year-old males).¹⁸

Similar to findings on broader participation rates, poor engagement amongst female students in early years impacts participation in later years and is creating a gender imbalance. By late secondary education, the male to female ratio in Year 12 STEM subjects is three to one in physics and nearly two to one in advanced mathematics. This picture is worse for tertiary education, with 16 per cent of graduates from STEM-related courses being female.¹⁹

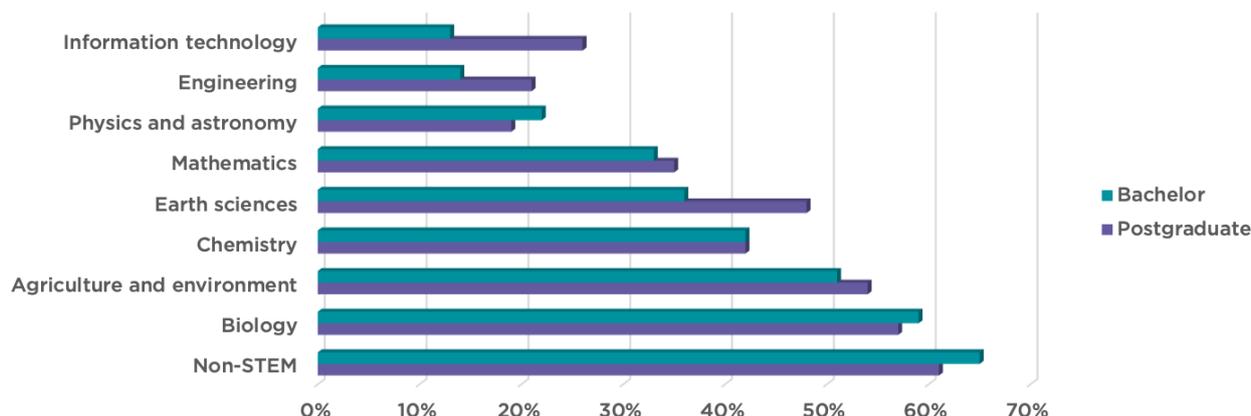


Table 2: Per cent of female domestic students completing STEM degrees in 2015²⁰

¹⁴ Engineers Australia, [Diversity in engineering](#)

¹⁵ Workplace Gender Equality Agency, [Data](#)

¹⁶ Consult Australia, 2019 Skills Survey Results

¹⁷ Australian Chief Scientist, [Women in STEM: A story of attrition \(2016\)](#)

¹⁸ Ibid.

¹⁹ Ibid. (includes vocational courses)

²⁰ Ibid.

Looking further at engineering as an example, the gender imbalance at Australian universities is worse when breaking results down further (table 3 and 4). While it cannot be assumed what proportion of international students leave the country after graduation (or domestic students remaining in the country), the below tables highlight that the female talent pool for industry is likely reduced further when looking at student status and degree type. Here we see a higher proportion of female students remaining in the education system after completing a bachelor's degree and a significant international student cohort.



Table 3: Total engineering graduates by gender and domestic/international student status (2015)²¹

Degree Type	Domestic Female		International Female	
	Total	Per cent	Total	Per cent
Doctorates	140	23.2%	161	26.7%
Research masters	34	31.5%	50	41.3%
Coursework masters	299	19.4%	625	19.5%
Other postgraduate	156	18.4%	34	21.3%
Bachelors	1092	14.3%	676	19.4%
Associate degrees	54	9.5%	16	12.4%
Other undergraduate	18	7.5%	111	14.1%

Table 4: Female engineering graduates and domestic/international student status (2015)²²

²¹ Engineers Australia, [Australian Engineering Student and Staff Statistics from National Data Collections](#)
²² Ibid.

Potential causes

Research points to a number of barriers to female participation in STEM education, such as stereotypes that provide a gendered view on education choices and disengagement due to content being perceived as not inclusive or irrelevant because of gendered expectations.²³ Removing these barriers facing female students should form part of any approach on addressing Australia's declining participation rates in STEM education.

Barriers to female participation in STEM education can often relate back to cultural and family expectations.²⁴ An OECD study found less than five per cent of 15-year old girls in OECD countries are contemplating a career in engineering and computing. The study suggested these findings are due to a bias where parents are more likely to expect their sons to work in STEM fields despite the average performance between genders at this age being the same.²⁵

Addressing cultural barriers has been a focus of the Australian Chief Scientist over recent years, particularly by responding to myths and preconceived bias that are preventing females from actively participating in STEM education. This includes rejecting the view that women are disinterested in STEM education and related careers by highlighting the different experience in other countries, such as China where women account for 40 per cent of engineers, Malaysia where women make up 44 per cent of engineering graduates, and the former USSR where women accounted for 55 per cent of engineers.²⁶

Declining standards

Consult Australia's 2019 skills survey results highlight some areas of concern with the technical and practical quality of graduates entering the workforce. 49 per cent of firms indicated that graduates in general are not at a level of job-readiness when joining the industry.²⁷

A range of education performance standards also highlights concerns with Australia's STEM education standards, which have declined over recent decades. This decline has been described as a '20-year slide' in Australia's performance when results are compared to similar countries (tables 5 and 6).²⁸ Only seven per cent of Australian students today are performing at TIMSS advanced levels²⁹ for mathematics and science, compared to 42 per cent in mathematics and 25 per cent in science from the topic five performing countries. Australia's PISA ranking³⁰ has also declined over recent years, from fifth to 20th for mathematics between 2003 and 2015, and from fourth to tenth for science between 2006 and 2015.³¹

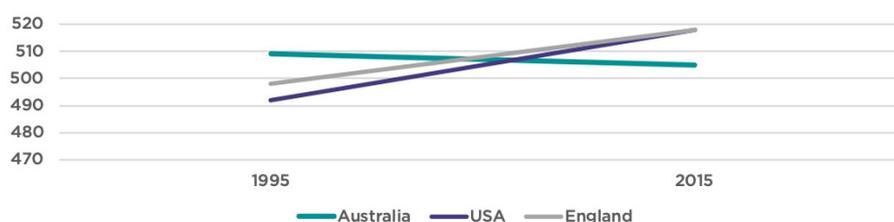


Table 5: Historical comparison of Year 8 TIMSS mathematics achievement scores (1995 to 2015)

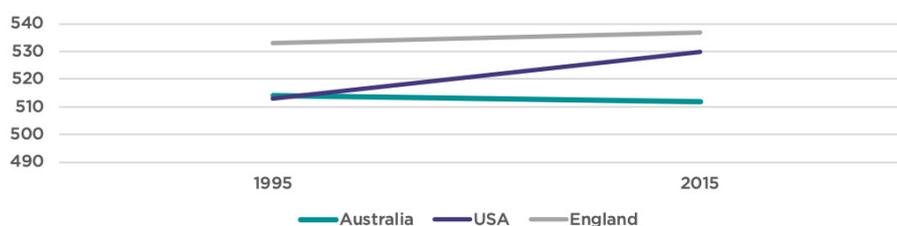


Table 6: Historical comparison in Year 8 TIMSS science achievement scores (1995 to 2015)³²

23 AAS and AATE, [Women in STEM Decadal Plan \(2019\)](#)

24 Ibid.

25 OECD, [The ABC of Gender Equality in Education \(2015\)](#)

26 Australian Chief Scientist, [Busting Myths about Women in STEM \(2016\)](#)

27 Consult Australia, 2019 Skills Survey Results

28 ACER, [20-year slide in maths and science learning \(2016\)](#)

29 Trends in International Mathematics and Science Study (TIMSS) by the International Energy Agency

30 Programme for International Student Assessment - worldwide study by the OECD

31 Australian Chief Scientist, [Science and Maths in Australian Secondary Schools \(2017\)](#)

32 ACER, [TIMSS 2015: a first look at Australia's results](#) (table 5 and 6)

NAPLAN results³³ for numeracy also provides an insight on Australian standards. Between 2008 and 2017, numeracy scores have stagnated regardless of the year level being assessed.³⁴ Results of disadvantaged students have also declined sharply with the gap between high performing students being the equivalent of seven years.³⁵ We are also seeing a difference in secondary education standards of one year in mathematics and 1.5 years in science between the best and worst performing jurisdictions (tables 7 and 8).

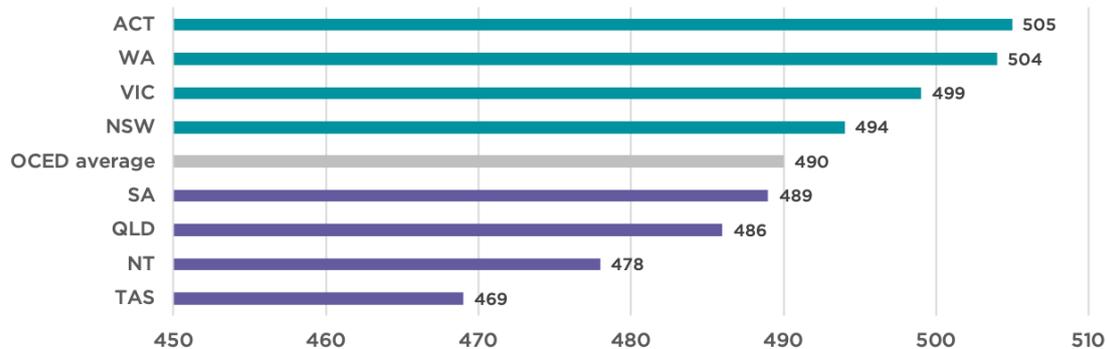


Table 7: PISA performance results for mathematics by Australian jurisdiction in 2015

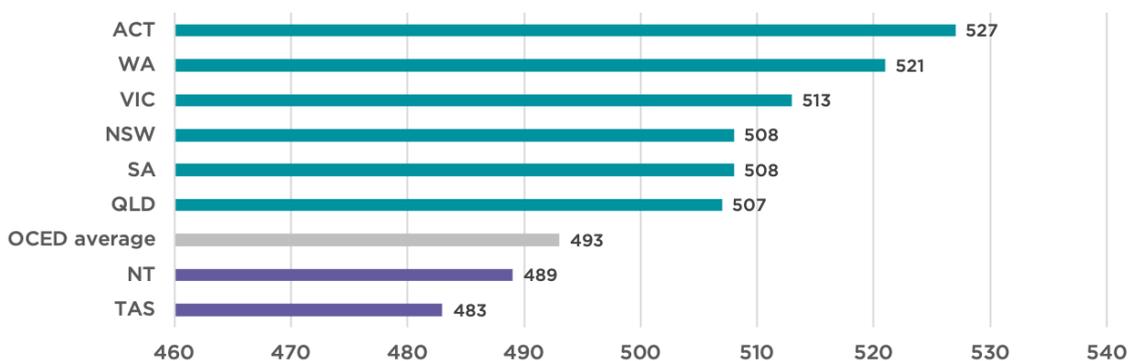


Table 8: PISA performance results for science by Australian jurisdiction in 2015³⁶

It should be noted that while the previous tables highlight high-level statistics on STEM education standards and changes over time and between jurisdictions, it should be noted there are limitations with reading this data on face value only. These limitations include the local context (i.e. factors that sit outside the education system) and advanced statistical techniques required to present mixed data into a like-for-like comparison.³⁷ However, notwithstanding these limitations, they do provide an insight on how standards vary over time and between jurisdictions.

Potential causes

One potential cause for Australia's STEM education standards is that curriculum is not covering the right content and tends to promote project-based activities instead of inquiry and problem-based learning. It has been argued that Australia's curriculum is not based on a 'modern conceptualisation of STEM', and struggles to integrate learning progression across school years.³⁸ Another challenge is determining how STEM is incorporated into an already crowded curriculum when each area comprises of multiple sub-disciplines that can be broken down into sizeable fields. This makes it difficult for curriculum designers to define the knowledge and skills necessary for STEM education.³⁹

Another potential cause is a shortage of STEM qualified teachers.⁴⁰ This shortage is resulting in an alarming number of teachers who are 'teaching out of profession' for STEM subjects.

³³ National Assessment Program: Literacy and Numeracy – standardised skills testing of Australian students

³⁴ The Educator Australia, [New NAPLAN data released](#) (2018)

³⁵ Teach for Australia, [2016 NAPLAN results raise concerns about excellence and equity](#)

³⁶ ACER, [2015 Key Findings](#) (table 7 and 8)

³⁷ Future Learn, [Some criticism of TIMSS](#)

³⁸ ACER, [Challenges in STEM learning in Australian schools: literature and policy review \(2018\)](#)

³⁹ Ibid.

⁴⁰ Australian Chief Scientist, [STEM: Australia's Future \(2014\)](#)

For example, around 20 per cent of secondary maths and science teachers, and around 30 per cent of secondary IT teachers, have no related qualifications.⁴¹ Particularly when considering the complexity of STEM skills that need to be applied and learned,⁴² this likely limits a teacher's ability to understand concepts in a way that allows them to confidently deliver a learning experience that inspires an interest in STEM.

Areas of strong performance

While there are challenges with Australia's STEM education performance, there are also pockets of excellence, particularly the focus on embracing new technology and the focus on new innovative STEM skills. For example, the University of Melbourne in partnership with a consortium led by Lendlease has created a new innovation precinct connecting the research sector with industry, governments and students to promote collaborative innovations within STEM disciplines.⁴³ The University of New South Wales (UNSW) has a student project initiative that aims to address real-world challenges through innovative cross-disciplinary practices. Some of these projects include hyperloop technology research and delivering humanitarian projects in developing countries through innovation engineering solutions.⁴⁴

Arguably the challenge facing Australia's STEM education performance in this regard is that the focus on new technology and innovative STEM skills is not widespread and appears to be more prevalent in the later years of STEM education. A challenge for industry in this regard is to embrace and promote these opportunities and practices through partnerships with university students and the research sector.



School photo created by pressfoto

41 Australian Chief Scientist, [Science and maths in Australian secondary schools \(2017\)](#)

42 ACER, [Challenges in STEM learning in Australian schools: literature and policy review \(2018\)](#)

43 The University of Melbourne, [Melbourne Connect](#)

44 UNSW, [Student Projects](#)

Improving Australia's STEM education outcomes

Background

The importance of improving Australia's STEM education performance and understanding related challenges has been recognised by governments, the education sector and industry. Over recent years, there has been a focus on putting in place measures and initiatives at schools and universities, and in the broader community, to help improve participation in STEM education and overall standards.

This section analyses the current approach of governments, and reviews initiatives currently being delivered by industry, the education sector and other organisations.

Approach by governments

Government responsibility for the education system is shared between the Commonwealth and individual state and territory governments. The Australian Government is predominately responsible for the higher education sector and early learning education. Individual state and territory governments provide the main oversight of primary and secondary education, and support other technical and further education arrangements. The Australian Government also plays a role in these other education types through funding arrangements to support the delivery of education services, and by coordinating reforms to meet nationally agreed outcomes.⁴⁵

Scattered oversight and management responsibilities between different levels of government has resulted in a scattered range of approaches to overseeing Australia's education systems and improving the performance of STEM education. There have been attempts to provide consistency between the different approaches of governments, particularly through the Council of Australian Governments' (COAG) Education Council and the recent National STEM School Education Strategy. The COAG Education Council aims to provide a strategic policy forum where national issues can be addressed through a coordinated and collaborative approach.

The National STEM School Education Strategy, released in 2015, attempts to provide this coordinated and collaborative approach in response to the Australian Chief Scientist's call for a strategic approach in response to a lack of progress and concerning trends. The strategy includes overarching goals on all students having strong STEM skills and being inspired to take on more challenging STEM subjects at school. The strategy also includes five objectives:

1. Increasing student STEM ability, engagement, participation and aspiration;
2. Increasing teacher capacity and STEM teaching quality;
3. Supporting STEM education opportunities within school systems;
4. Facilitating effective partnerships with tertiary education providers, business and industry; and
5. Building a strong evidence base.

A particular focus of the strategy was to coordinate targeted efforts across the country in key areas where collaborative action will deliver more improvements, including establishing a professional learning exchange to improve teaching quality, creating partnership forums between education sector and industry, and tracking and reporting on participation and attainments.⁴⁶

An action from the strategy was for governments to respond to its goals and objectives through localised strategies and actions plans. While the attempt was for overall consistency, the localised strategies and action plans have resulted in a series of bespoke approaches that arguably cannot be attributed to unique local circumstances relating to STEM education performance. While the strategy is for a ten-year period, and is in different stages of implementation across the country, the core goal of a coordinated approach to improving Australia's STEM education performance has not been structurally achieved. This will likely reduce the chances of the strategy's goals and objectives being achieved by the end date – particularly in a balanced way across the country.

45 Australian Department of Foreign Affairs, [The Australian Education System](#)

46 COAG Education Council, [National STEM School Education Strategy \(2015\)](#)

The different approaches governments are taking when developing localised strategies and action plans, are outlined below.

Five distinct government approaches

Australian governments have taken a diverse approach to improving STEM education performance and addressing challenges. These are summarised in Annex A. From our review of these different approaches, we believe they fit within the following five distinct categories:

- A skills outcomes approach focused on job and economic growth opportunities;
- An education system-wide approach focused on holistic improvements;
- An intervention approach on underperformance and areas of concern;
- A comprehensive approach focused on interventions, skills outcomes, and system-wide improvements; and
- A light touch approach influenced by the COAG strategy but has not yet implemented localised targeted initiatives.

Skills outcome approach

Western Australia, the Northern Territory, and New South Wales are three jurisdictions that appear to emphasise skills outcomes from STEM education by linking future economic opportunities and jobs growth to their approach. In the case of WA and the NT, this may be driven by a desire to identify new opportunities post-mining boom and to reduce local impacts from future fluctuations in the mining and resources market.

A strength of WA's approach is the partnership initiatives with industry and the community, such as those led by not-for-profit organisations such as SciTech. There is a focus on improving education standards by aligning to industry needs, future skill demands, and promoting community benefits. The significant focus on industry appears to be unique when compared to other jurisdictions, and this may be a factor in WA's higher STEM education standards. This perhaps results in more efficient and effective initiatives, particularly when compared to the level of investment and activities in other jurisdictions.

The focus on developing STEM-related skills in the NT appears to be a recent priority for the government, particularly given the timing of the release of the NT's STEM education strategy and the Digital Territory Strategy. This digital approach outlines the case for embracing new technology and the digital world, and recognises the importance of STEM education in schools for encouraging digital careers and the value of cross sector work readiness programmes as first steps in the strategy's action plan.

The NSW focus is on ensuring training and education outcomes are delivering the STEM skills needed for future job opportunities in related STEM skills. The Job for the Future Strategy identifies a link between new jobs and the need to develop knowledge-intensive skills that focus on technology, and the strategy prioritises reforms to help realise this benefit.

It is important to note that the NSW approach appears to be skills focused because the State has not yet released its STEM education strategy (called 'NSW STEM Foundation') which was flagged for release in 2018. As a result, while the NSW approach has a strong jobs focus, it also appears more ad hoc and less effective than other jurisdictions. The release of the STEM education strategy, which will outline a ten-year investment in the development and retention of STEM skills, will likely scale up and provide an integrated approach.

System-wide approach

At this stage, the ACT Government appears to have a 'business as usual' approach to STEM education outcomes in the territory. Improvements to STEM education have been included as part of the broader approach to improving the system as a whole and ensuring future arrangements are fit for purpose.

Given the ACT is the lead performer in Australia when it comes to student performance in science and mathematics at a year 8 level, there does not appear to be the same need to take a targeted approach to improving STEM education as is the case in other jurisdictions. This appears to be the logic with the ACT's future of education strategy.

Intervention approach

At the Federal level there is an interventionist approach, with a significant focus on targeting gender diversity, which usefully supplements the activities of most states and territories and avoids unnecessary overlap. The Australian Government has also implemented some of the national actions from the COAG strategy, such as the STEM Partnerships Forum.

While the Australian Government takes an interventionist approach in regard to focus areas for improving performance, the interventions are backed up by a strategic and evidence-based approach. For example, the recently released Women in STEM Strategy and Decadal Plan outlines how stakeholders can effectively drive a change through this specific intervention.

The Australian Government could take a similar interventionist approach to other areas relating to Australia's STEM education challenge, including the higher education sector where the Commonwealth has predominate oversight. This could be in line with the previous Enhancing the Training of Mathematics and Science Teachers programme which was discontinued in 2016.⁴⁷ There may also be opportunities for the Australian Government to link incentives to funding for education providers and oversight of standards and the quality of tertiary education across Australia to drive performance improvements, and other funding for states and territories to the COAG or a new Federal strategy.

Comprehensive approach

Queensland, South Australia and Victoria have the most comprehensive approaches in regard to their strategies and initiatives in place. These strategies provide a synopsis of challenges at play, evidence-based initiatives that focus on addressing systemic issues, and provide significant funding to improve STEM education facilities and resources. These strategies also effectively follow a child's development journey and consider measures at key points when STEM education outcomes stagnate or decline.

The Queensland Government is focused on the three key performance areas outlined in this discussion paper – the quality of STEM education, participation and the diversity of those participants. Queensland's approach is also well-balanced between improving existing practices (i.e. refining how STEM is delivered in the classroom), and ensuring the education arrangements are fit-for-purpose for future skill needs, particularly in areas of strategic interest (such as innovation).

South Australia's approach focuses on learning environments for students, STEM teaching skills, and in-demand STEM skills for the future. Most of the initiatives date back to 2016 and represent a concentrated effort to increase the State's performance over coming years. South Australia has identified innovation and technology as key areas to transform the economy away from the traditional manufacturing sectors, and has linked STEM and local skills as important factors in driving this change.

Victoria's strategy provides a comprehensive summary of ongoing and new initiatives that aim to improve quality and uptake in key areas. This plan starts with early learning, with initiatives such as Let's Count, and continues right through to the interface with industry. The strategy is backed up by investments in facilities, new tech schools, and resources and curriculum for STEM educators. Other activities by Victoria's Lead Scientist and Chief Engineer aim to connect the range of initiatives together to increase their accessibility to the public, and to identify gaps for future improvements.

Light touch approach

Lastly, Tasmania has the lightest approach compared to other jurisdictions, particularly when considering local standards. The STEM Framework sets a series of goals, objectives and principles to improving standards across the State, however this document does not include practical examples of how these ambitions will be realised or measured. The design of the framework is therefore difficult to implement, and this may explain in part why there are few initiatives on improving STEM education and skills outcomes.

⁴⁷ Australian Department of Education and Training, [Enhancing the Training of Mathematics and Science Teachers Program](#)

The lack of targeted and substantial action on improving STEM outcomes in schools may be due to some bigger challenges facing Tasmania's education system. These include student retention, and the focus on improving overall NAPLAN performance results.

Activities led by industry and the education sector

In addition to government approaches, industry has designed and delivered many initiatives focused on partnerships with STEM students and teachers. The education sector, particularly universities, has also developed a number of their own initiatives in addition to their involvement delivering government measures.

Activities led by industry and the education sector have a mixture of focus areas and approaches, such as a focus on gender diversity, lower socioeconomic areas and different age groups. While many of these activities have a broader STEM focus, some specifically aim to promote education, skills and the related careers on particular disciplines such as science or engineering. The following ten case studies provide a summary of best practices.

Case study 1: GHD's STEM Pathways

GHD has implemented numerous initiatives within the workforce and at universities to support, retain and attract women and in 2017, broadened the approach to include high school aged girls. During the STEM Pathways week, GHD hosts students from local high schools for an immersive week of work experience. The girls take on roles in a mock project, acting as the architect, engineer, urban designer, planner or environmental scientist with LendLease acting as the client. At the conclusion of the week, the girls provide an engaging overview of the project, client, what they learned and interesting facts or experiences from the week.

Given the time constraints many people experience in industry, the approach for this program is to maximise the number of people involved, but minimise the amount of time they need to commit. Throughout the week, over 100 people from GHD, City West Water, Lendlease, Lotsearch, RMIT and the participating high schools were involved in various activities.

The feedback has been overwhelmingly positive, with the girls enjoying the teamwork, variety, relevance of the mock project and learning new things. Several of the girls commented that they could see themselves pursuing one of the careers that they had been exposed to during the STEM Pathways week and others were reconsidering dropping core STEM subjects such as Maths Methods and Physics.



Case study 2: Northrop and Robogals

Northrop Consulting Engineers Canberra Region proudly sponsored Robogals - Canberra. Robogals is an international not for profit female student led society with the mission to directly increase the female representation in the STEM industries, particularly engineering. They do this by running engineering related workshops throughout schools all over the world to engage and inspire young women.

During 2017/18, within Canberra alone, 50 university students were trained, who ran workshops at 70 schools and reached 1500 girls. Northrop Canberra's sponsorship of Robogals provided direct opportunities to connect and engage with girls and young women who aspire to pursue careers in STEM industries, and bridge the gender gap in STEM related fields.



Case study 3: Arcadis' support for university STEM initiatives

Arcadis supports a number of university lead STEM initiatives whilst also integrating a focus on supporting attraction of females into STEM careers into development programs run for Arcadians.

Each year Arcadis hosts the participants of the UNSW Women in Engineering Summer Camp when 50 to 100 students visit their Sydney office for half a day to take part in a range of activities to better understand the industry and opportunities available. As part of the day there is the competition for students to win week of work experience. One of the female members of the regional leadership team is an active mentor for the University of Western Sydney 'girls in property' program.

As part of their Women@Arcadis program Arcadis hosted a half-day session with 25 Year 10 STEM students from local girls schools which focused on better understanding the industry and supporting building skills critical to a variety of roles (e.g. creativity and problem solving). As a result of this one attendee has now come back for three work experience weeks and is applying to do engineering at university. With a similar design to this, as part of their 'Project Management in Practice' program, Arcadis host a half-day session with 50 male and female year 10 STEM students in order to understand how the role of a project manager fits into the industry.

Building on from these successful events, in August 2019 Arcadis hosted a Science, Technology, Engineering, Arts, and Maths (STEAM) week with three events during the week, one taking place in each of their East Coast offices. Each event had 20 to 30 female students from local schools engaging in exercises covering critical thinking, collaboration and problem solving. There was also the opportunity for students to ask questions around career experiences and areas our people are passionate about. The intention was to help bring to life the variety of opportunities that a career in our industry offers. The outcome is to raise awareness and interest in a career within our industry in order to inspire their future choices.



Case study 4: Northrop Grumman and Australian National University (ANU)

In November 2018, ANU's College of Engineering and Computer Science announced a partnership with Northrop Grumman (an aerospace and defence company) for a research project to better understand how young women interact and learn within STEM subjects, and to improve retention of female students in STEM tertiary education.

The research project will engage students to discuss current experiences and motivations with STEM education, including at primary and secondary schools around Australia.

Over the long term, the project hopes to achieve a more diverse and engaged student population for engineering and computer science degrees with a 50/50 gender split.

The project is hoping these goals will help result in downstream benefits, such as helping to address the shortage of STEM talent in our workplaces, and improving the development of Australia's high-technology culture.⁴⁸



Australian
National
University

Case study 5: Generation Hydro

Acknowledging that society as a whole is becoming increasingly reliant on technology and demands for STEM professionals is increasing, Hydro Tasmania has developed an education programme called Generation Hydro. Hydro Tasmania is a government-owned electricity generator, and their initiative aims to build interest in STEM education and to allow teachers to harness the resources of the utilities company.

The education programme provides real-world relevance of STEM skills to students, demonstrating how these skills are being used to produce energy and manage water flows. The programme has been designed to support Tasmania's education department's Learners First Strategy which aims to promote innovation. It is delivered through a combination of in-class visits and tours of power stations and dams, and focuses on showcasing STEM careers.

The programme focuses on primary school students, however current focus in 2019 is on developing resources for secondary schools and adding more activities for primary schools.⁴⁹



⁴⁸ Australian National University, [ANU and Northrop Grumman to address diversity in STEM \(2018\)](#)

⁴⁹ Hydro Tasmania, [Generation Hydro](#)

Case study 6: Work experience at Rudds Consulting Engineers

Rudds Consulting Engineers has introduced a new work experience policy that involves offering university students the opportunity to participate in workplace experiences over timeframes longer than the minimum 12 weeks required by many institutions as a prerequisite for graduation.

Rudds' policy has also proven successful as a recruitment activity with many work experience students remaining with the organisation after they graduate. Another benefit of longer work experience opportunities is that it provides students more practical training in specific engineering industry disciplines making them more job ready when they commence full-time work.



Case study 7: Solar Railways Technology Challenge

The Solar Railways STEM Challenge aims to engage, inspire and educate secondary students in real world major infrastructure projects. The challenge has been developed by Re-Engineering Australia (REA) Foundation, a social enterprise promoting engineering and technical careers.

Teams of students adopt a regional community along the Inland Rail corridor, learn about its energy needs, and design a large-scale solar array utilising existing rail infrastructure. The project facilitates engagement with industry and industry role models, and aims to make a career in the rail industry desirable.

The competition is free, it requires students to work with a range of STEM principles, including surveying, infrastructure planning, power analysis, to develop real world solutions. The competition targets secondary schools students.⁵⁰



50 REA Foundation, [Solar Railways Technology Challenge](#)

Case study 8: Cardno at St Clare's College in Canberra

Cardno recently participated in a STEM event with a theme of 'I want to be her when I grow up' organised by the Australian Computer Society (ACS), KPMG and Women in Information and Communication (WIC). The event was held in late May 2019 at St Clare's College, a Catholic girls secondary college in the Australian Capital Territory.

The event enabled students to connect with STEM mentors and build their understanding of the number of diverse pathways to a STEM career. The aim of the event for ACS and partners was to build the interest of students in STEM education and careers as this tends to peak and drop off from around the ages of 13-15 for girls. This drop off is caused by a number of reasons including unconscious bias, limited visibility of these career opportunities, and a lack of support at home.⁵¹



Case study 9: Exploring STEM Careers Holiday Programme

A programme by the University of New South Wales, supported by Science 50:50 and Women in Engineering, that provides an opportunity for participants to meet professional scientists and engineers to learn about where they work and their role.

The week long programme consists of site visits to four companies or organisations where scientists and engineers work, plus workshops and activities on the UNSW campus.

The programme is targeted at female Year 10 students, and is part of the university's aim for 30% enrolment in engineering by 2020. Participants also come from regional NSW or interstate, and has included students from overseas.⁵²



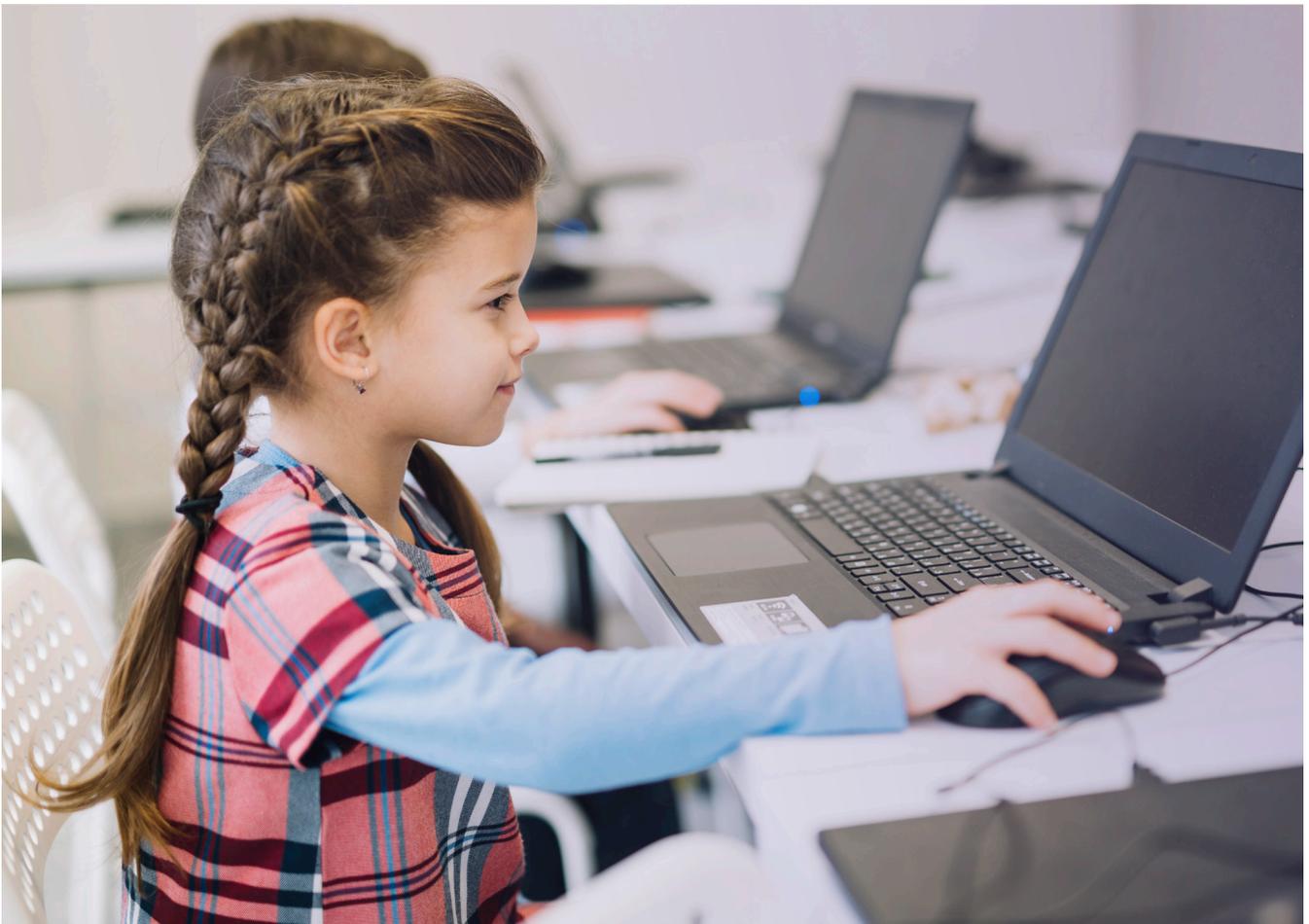
51 ACS, [Canberra STEM event - 'I want to be her when I grow up'](#) (May 2019)

52 UNSW, [Exploring STEM Careers Holiday Programme](#)

Case study 10: Code Club

A nationwide network of volunteer-led coding clubs with the goal of teaching and promoting coding skills to children. Code Club Australia provides free resources, training and events to communities all over Australia, including teacher training, workplace training and extra-curricular activities for children. The network in Australia was founded in 2014, and is a registered charity and receives funding from a number of corporate and government organisations.

Code Club is targeted at primary and early secondary students and aims to help children develop computational and problem solving skills. There are over 2000 clubs across Australia. 165,000 children have participated in the initiative in Australia and 3,200 teachers have completed the teacher training component.⁵³



People photo created by freepik

53 Code Club Australia, [What is Code Club?](#)

Key findings

In reviewing activities led by industry and the education sector focused on improving STEM education outcomes, a number of common themes and potential gaps can be identified.

Firstly, while there are examples of activities that focus on engineering and other skills related to the built and natural environment, these are less frequent than those focusing on science, technology and broader STEM skills. For example, the Australian Government's supported search website for initiatives, STAR Portal⁵⁴, identifies 266 initiatives that cover engineering out of 630. This compares to 415 that cover science and 318 that have a technology focus.

Of the engineering-related activities identified in the review, a focus appears to be on developing and applying STEM-related skills rather than on the outcomes being delivered by utilising these skills. There is a potential gap here in terms of highlighting social and economic benefits from engineering skills, particularly on opportunities provided to individuals and communities through engineering solutions. A focus on outcomes from engineering skills and careers will likely resonate with a broader range of students, such as those who may have less of an upfront interest in engineering processes.

While the Generation Hydro case study provides a good example of an industry-driven initiative promoting related career options, many of the activities reviewed are heavily driven by the education sector and tend to showcase opportunities at universities. While showcasing STEM education options encourages students to remain in the pipeline, limited exposure to industry and related careers likely makes it difficult for many students to conceptualise these options and opportunities.

There also appears to be a limited number of initiatives focused on developing ongoing relationships with students through their curriculum or as an extra-curricular activity. Many initiatives instead focus on short learning exposures. While many do focus on providing role models for students, longer term mentoring may be more effective at supporting and motivating students.

The review of activities highlights a difference in the purpose and design of those aimed at primary students and those aimed at secondary students. Initiatives aimed at primary students focus on exposure – showcasing STEM and demonstrating how skills are utilised at a high-level. Initiatives aimed at secondary students focus on excellence and inspiring students to pursue STEM education – providing hands-on learning experiences, encouraging students to utilise skills and problem-solving activities based on real-world scenarios.

54 Australian Government, [STAR Portal](#)

Opportunities and next steps

In addition to the development of this discussion paper, Consult Australia has developed a work plan of activities to support its thought leadership series highlighting the importance of STEM education and the pipeline of STEM talent for Australia's future.

Consult Australia sees a number of opportunities to better understand the complexities behind Australia's current STEM education outcomes. Findings from this discussion paper highlight that there are a number of ongoing and systemic challenges facing STEM education in Australia, which are not and will not be solved through high-level solutions or by one stakeholder alone. However, increasing the attention on these challenges and providing an industry perspective and partnership approach, particularly on future workforce demands, can perhaps help provide longer-term solutions to these challenges.

A focus over the next six months will be seeking feedback on this discussion paper from stakeholders in government, the education sector, community group and industry. The aim of these discussions will be to help inform Consult Australia's next discussion papers in this thought leadership series.

Consult Australia's work plan related to STEM education includes:

- Better understanding our industry's current and future workforce demands, and promoting alignment with the design and delivery of the STEM education curriculum;
- Articulating the downstream benefits from improved STEM education performance for consulting firms providing design, advisory and engineering for the built and natural environment, such as export opportunities from a global hub of excellence;
- Designing and delivering an industry initiative focused on promoting STEM education and building an interest in our industry; and
- Developing recommendations for governments and other key stakeholders on opportunities to strengthen Australia's future talent pipeline, which will include recommendations on improving current outcomes.

Further details on this work plan is below.

Better understanding future workforce demands

There is no doubt that our built and natural environment, and the delivery of new projects, will transform through technology, innovations and new practices. This naturally will have a significant impact on the sector's future workforce demands, particularly on the skills needed for the workplaces of tomorrow.

For example, Google and KPMG have recently entered an alliance to help transform businesses and operating models with automated intelligence (machine learning) and advanced analytics technologies. In the United Kingdom, Mastercard has worked with Transport for London to improve the user experience with their ticketing system by enabling contactless payments through bank cards. Globally, Microsoft launched their 'CityNext' initiative in 2013 which provides a range of services to improve how the build environment operates, primarily focused on making cities and infrastructure more digital.

As demonstrated by these examples, the focus and performance of STEM education must equip the talent pipeline with the skills needed for future workplaces. It is clear that we will see an increase in demand for hybrid STEM skills – the ability to deliver 'soft' digital and technology solutions with 'hard' engineering skills. Underpinning these skills will be creative thinking and a blend of digital skill sets with core expertise. It has been suggested that these changing demands require a 'STEAM' approach that includes the arts to guide student inquiry, dialogue and critical thinking.

Consult Australia's initiative on STEM education

There is currently an extensive range of STEM education initiatives led by industry, the education sector and community organisations that aim to promote opportunities arising from STEM education, and to help address some of the challenges relating to the quality, quantity and diversity of Australia's STEM talent pipeline. However, this report identifies two gaps, a lack of engineering-focused initiatives, and the development of ongoing relationships with students with an interest in STEM careers through a work experience or extra-curricular programme.

Consult Australia will use the findings from this report to design and deliver a STEM education initiative focused on highlighting career options at consulting design, advisory and engineering firms. The focus will be secondary school students, particularly from backgrounds under-represented in the sector.

The initiative will be developed with Consult Australia's Male Champions of Change programme, People and Human Resources Roundtable, and our state and territory division committees. In its consultation of this discussion paper, Consult Australia will look for opportunities for partners in industry, and the education and community sectors, particularly around designing an informed curriculum.

Consult Australia will also look to pilot its initiative in a jurisdiction before rolling it out across the country. A focus will be on ensuring the impact of the initiative can be tangibly measured.

Developing recommendations to improve STEM education outcomes

Finally, Consult Australia will develop a series of recommendation on ways that governments, the education sector, industry and other stakeholders can together improve STEM education outcomes. A focus for this final discussion paper will be better understanding the different approaches of governments across Australia to improving STEM education outcomes that we have outlined in this paper.

A goal is to identify a best practice approach for governments, discuss how they can better coordinate their approach in line with the objectives of the COAG National STEM Schools Strategy, and to better understand how local factors can be considered in this approach.



Contact us

We would welcome any opportunity to further discuss the issues raised in this report. To do so, please contact:

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Approach of Australian governments to improve STEM education outcomes

	STEM education strategy ⁵⁵	Key STEM education initiatives	Other recent related initiatives
Commonwealth	<p>While the Australian Government has no specific strategy in place focused on improving STEM education outcomes across Australia, the COAG Education Council's <i>National STEM School Education Strategy</i>⁵⁶ serves this purpose by providing a coordinating and Australia-wide approach.</p> <p>The Australian Government's <i>National Innovation and Science Agenda</i>⁵⁷ also provides a strategic approach to improving STEM education and skills outcomes through initiatives under the \$64 million 'Inspiring all Australians in Digital Literacy and STEM' budget measure.</p> <p>Lastly, it is important to note that the Australian Government is predominately responsible for overseeing the tertiary education sector, including subsidies for tuition costs and performance oversights. As such, there is no strategy in place focused on improving STEM education outcomes at the tertiary level.</p>	<ul style="list-style-type: none"> • <i>STEM professionals in schools</i> led by CSIRO – partners teachers and professionals to improve practices. • <i>reSolve: maths by inquiry</i> – provides teaching support to learn mathematics in innovative ways • <i>Digital Technologies Hub</i> – an online resource portal for teachers, students and families. • <i>Curious Minds</i> – targets high-achieving girls in years 9 and 10 through residential summer schools and a mentoring programme. • <i>Science by Doing</i> – online science resources for teachers and year 7 to 10 students. • <i>Early Learning Pilot</i> – a series of play-based applications for pre-school aged children delivered in partnership with the University of Canberra. • <i>STARportal</i> – national portal to connect parents, students and teachers with STEM activities. 	<ul style="list-style-type: none"> • A <i>Women in STEM</i> strategy to coordinate the Government's efforts and Women in STEM Decadal Plan released in early 2019; • An industry-led decadal plan to make STEM education and careers more attractive; • A Girls in STEM toolkit to help better understand STEM careers; and a Women in STEM Ambassador. • The <i>Women in STEM and Entrepreneurship (WISE)</i> grant programme targeting women and girls of all ages and backgrounds to foster interest in STEM, and to encourage greater participation. • <i>Skilling Australians Fund</i> – responding to the skills required by employers and supporting apprentices and trainees. Funding has currently been made available between 2017-18 and 2021-22, with projects under the fund being developed with state and territory governments signed up to the Skilling Australians Fund National Agreement. Funding will be prioritised for support in future growth sectors, including engineering, building and construction, and digital technologies.
ACT	<p>The ACT Government does not have a specific strategy focused on improving STEM education outcomes. The ACT Education Directorate noted their broader approach to STEM aligns with the National STEM School Education Strategy. Additionally, the broader <i>Early Years Learning Framework for Australia (EYLF)</i> used in the ACT is also supporting the implementation of STEM focused action learning projects to improve teaching practices.⁵⁸</p>	<ul style="list-style-type: none"> • The <i>Centre for Innovation and Learning</i> opened in 2018, supported by 47 teachers to plan and co-deliver STEM education programmes for students in pre-school to year 10. The centre also hosts professional learning workshops for public school teachers in STEM related areas. • Teacher scholarship programme for further study in priority areas of STEM. 	<ul style="list-style-type: none"> • The <i>Future of Education Strategy</i>⁵⁹ – outlines the plan for education in the ACT over the next decade. The focus is broader than STEM, and instead aims to improving teaching skills, and building better partnerships with the community.
NSW	<p>The NSW Government does not have an individual STEM education strategy in place; however, one is currently under development. The <i>NSW STEM Foundation</i> will outline a holistic approach and a series of programmes to attract more diverse, high-potential students into STEM education, and to retain high-performing students in STEM-related sectors.</p> <p>This strategy was originally proposed in the NSW Government's Innovation Strategy in November 2016, to be developed in partnership with the CSIRO, and was originally expected to be finalised in Q3 2018.</p>	<ul style="list-style-type: none"> • <i>NSW future skills</i> – an upcoming initiative aimed at identifying opportunities to increase participation in STEM subjects, and to better understand how to improve student outcomes; and • <i>STEM resources</i> – an online hub which includes illustrations of practice and resources for teachers to use to improve the quality of STEM education. • The establishment of <i>STEM Action Secondary Schools</i> to mentor and share innovative STEM practice and programmes with schools. A goal of this programme is to lead a community of practice in the teaching of STEM. 	<ul style="list-style-type: none"> • <i>Jobs for the Future Strategy</i>⁶⁰ – a 20-year plan for creating new jobs by developing new knowledge-intensive skills focused on technology. A priority under this strategy is accelerating reforms for integrating interactive-skills learning in skills, which includes specialist STEM skills.

⁵⁵ In addition to the COAG Education Council's National STEM School Education Strategy

⁵⁶ COAG Education Council, [National STEM School Education Strategy \(2015\)](#)

⁵⁷ Australian Department of Industry, Innovation and Science, [National Innovation and Science Agenda Report \(2015\)](#)

⁵⁸ ACT Education Directorate, [Annual Report 2017-18](#)

⁵⁹ ACT Education Directorate, [Future of Education Strategy \(2018\)](#)

⁶⁰ Jobs for NSW, [Jobs for the Future: Adding 1 million rewarding jobs in NSW by 2036 \(2016\)](#)

	STEM education strategy ⁵⁵	Key STEM education initiatives	Other recent related initiatives
NT	<p><i>STEM in the Territory Strategy 2018-22</i>⁶¹, launched in November 2018. The strategy aligns work across all schools to the objectives established in the National STEM School Education Strategy.</p>	<ul style="list-style-type: none"> The <i>STEM in the Territory Strategy 2018-22</i> includes a number of aspirations or 'key actions' relating to the goals of the National STEM School Education Strategy. These key actions include equipping students with coding skills, implementing the Australian Curriculum in STEM disciplines, and developing a strategy to attract, recruit and retain specialist teachers. 	<ul style="list-style-type: none"> The NT Government launched a digital strategy⁶² in October 2018, creating a framework to diversify and strengthen digital capabilities for communities and business. The strategy focuses on developing skills, knowledge and capabilities to succeed in the digital world, and includes an annual action plan to implement the strategy. Initiatives in the 2018-19 action plan include developing STEM centres of excellence at numerous schools, and encouraging digital careers through cross sector work readiness programmes.
QLD	<p>A strategy for STEM in Queensland state schools,⁶³ released in 2016, aims to increase participation of students in STEM subjects, including girls and Aboriginal and Torres Strait Islander students, to give every state school access to a specialist STEM teacher, and ensure all state schools offer the Digital Technologies curriculum, including coding and robotics.</p> <p>Furthermore, the Queensland Government released the Engaging Queenslanders in Science Strategy in 2016. This is a comprehensive community-wide strategy that aims to increase participation in school STEM subjects, to increase engagement, and to increase engagement between scientists and the community.</p>	<ul style="list-style-type: none"> The Government conducted a review of STEM education in 2016. Findings outline the need for diversity in STEM participation, research in emerging areas of engineering, external STEM partnerships, and increasing the skills of STEM primary teachers. <i>Coding Academy</i> is supporting the implementation of the Australian Curriculum: Digital Technologies across the state through hands-on learning experiences. Students entering undergraduate primary education programmes are required to have a 'sound achievement' in a senior mathematics subject and a science subject as a pre-requisite from 2016 onwards. <i>STEM Girl Power Initiative</i> - a 12-month programme that encourages girls to participate in STEM by engaging in a range of exciting experiences and inviting them to inspire other students. <i>STEM education partnerships</i> funding for organisations. <i>Entrepreneurs of Tomorrow school grants</i> - funding for schools or clusters of schools to nurture the next generation of digital entrepreneurs and to connections with industry. The <i>STEM Hub</i> brings together information, resources and advice for students and parents to learn more about STEM education, skills, and career opportunities. 	<ul style="list-style-type: none"> The current development of a skills strategy to ensure the state has the skilled population needed to attract investment, encourage job creation, and to take advantage of future opportunities. The Government anticipates this strategy will be released in 2019. A priority skills list identifying the qualifications and skill sets that attract government subsidy under the Annual VET Investment Plan. This list includes a number of STEM related qualifications. The <i>Training in Emerging and Innovative Industries Fund</i> focuses on priority and anticipated future skill needs. Funding was provided to industries impacted by digital disruption by supporting a transition or adoption of new practices by existing workers. The fund was a one-off opportunity in March 2018.
SA	<p>The South Australian Government launched the STEM Learning Strategy⁶⁴ in late 2016. The strategy aims to help young people take advantage of new STEM opportunities, and is underpinned by investments in school infrastructure and a range of STEM education initiatives.</p>	<ul style="list-style-type: none"> STEM Teacher Professional Development. <i>Bridging the Gap</i> is a research project initiated by the Government which sees Flinders University, schools and industry work together to improve teachers' ability to inspire students. <i>STEM Works</i> projects - investing \$250 million to provide new infrastructure for 139 schools. Construction of a new Adelaide city high school with a focus on STEM subjects and STEM-related facilities. Target of students with an ATAR in advanced maths, physics and chemistry subjects to 4,500 by 2022. Target of 500 primary teachers with a STEM specialty. Teachers will use a new approach to learning design and assessment from STEM education from 2017. <i>STEM play</i> initiative established at all government preschools from 2017 to 2020 to provide exposure to STEM concepts. Annual STEM leaders' symposium with the Preschool Directors Association, primary and secondary school principal associations, and the Australian Science and Mathematics School. 	<ul style="list-style-type: none"> STEM skills strategy - outlines priorities for developing a workforce with strong STEM skills, as well as the creativity and entrepreneurship skills that empower individuals to take their ideas through to commercial success. The investing in science action plan outlines initiatives to deliver on the STEM skills strategy. A career development approach with teachers, school leaders, industry and tertiary institutions to increase awareness of STEM-related career pathways. <i>Regional Science Hub</i> - an initiative creating a network of organisations that will collaborate to deliver ongoing community science engagement activities.

61 NT Department of Education, [STEM in the Territory Strategy 2018 - 2022 \(2018\)](#)

62 NT Government, [Digital Territory Strategy \(2018\)](#)

63 QLD Department of Education and Training, [A strategy for STEM in Queensland state schools \(2016\)](#)

64 SA Department of Education and Child Development, [STEM Learning: Strategy for DECD Preschool to Year 12 \(2017 to 2020\) \(2017\)](#)

	STEM education strategy ⁵⁵	Key STEM education initiatives	Other recent related initiatives
TAS	<p>The Tasmanian Government's <i>STEM Framework</i>⁶⁵ guides the education approach for STEM subjects by describing principles underpinning quality outcomes for school learners from early years through to year 12. It supports school leaders and teachers. The one-page framework seeks to align with the national strategy, and is designed to be relevant in a Tasmanian setting.</p> <p>The STEM Framework was launched in 2017.</p>	<ul style="list-style-type: none"> • STEM education website – launched in 2017 to share resources and to provide more information on STEM education. • <i>Amplify STEM</i> pilot schools – 22 integrated STEM units of learning developed by some schools across the State to align with the STEM Framework. • Teacher development initiative – teachers participating in intensive learning opportunities to build their expertise and specialisation in particular subject areas, including mathematics and science. 	<ul style="list-style-type: none"> • Ministerial priorities for training and workforce development 2018-21⁶⁶ – sets out objectives and actions related to Tasmania's skills development, and includes a number of STEM related sectors as priority industries.
VIC	<p>The Victorian Government's STEM plan, titled '<i>VicSTEM: STEM in the education state</i>'⁶⁷, brings together all actions that will help deliver the vision for improved learning and outcomes in STEM. The plan also starts a conversation about how Victoria can continue improving, and how to encourage greater involvement from communities and businesses. The plan covers early childhood and primary and secondary education, and also covers VET and higher education.</p> <p>The plan, launched in 2016, aims to:</p> <ul style="list-style-type: none"> • Promote positive early experiences of STEM; • Support effective STEM learning, engagement, and collaboration; • Connect educators, learners and families with STEM resources, programmes, and specialist support; and • Address the STEM-related training needs of industry, particularly in priority sectors. 	<ul style="list-style-type: none"> • <i>Let's Count</i> early numeracy programme – support for 500 educators and 7500 families to create learning experiences. Designed for three to five-year-old children, and towards disadvantages families. • Framework for improving student outcomes – uses latest research to focus efforts on key areas of improvement. • Investing \$10 million in tech schools located on TAFE or university campuses to raise awareness of education and training pathways. • Investing \$30 million in professional learning to build teachers' capability to teach and promote STEM. • <i>Secondary STEM Catalysts</i> programme – training 50 teachers to become experts in STEM teaching, to inspire fellow teachers to bring 'STEM to life' for year 7 and 8 students. • Investing \$21.6 million to support a new Victorian Curriculum, which will increase the focus on STEM and digital skills. • Network of six science and mathematics specialist centres. • STEM resources website – bringing together STEM resources, activities and programmes for educators, families and students. • Wolfram Technologies – software products rolled out in all secondary schools to provide a learning tool in areas of computation, problem modelling and coding. 	<ul style="list-style-type: none"> • <i>Skills First</i> – a new annual \$40 million workforce training innovation fund to support partnerships between industry, TAFEs and training providers to deliver innovation in workforce training, skills development and applied research. • Victoria's Lead Scientist Strategic Plan 2018-20 – outlines deliverables for key priorities related to promoting the importance of STEM across the economy, fostering linkages between governments with universities and business, and developing a whole-of-government STEM policy. • Connecting Victoria's STEM Ecosystem – a map highlighting programmes and opportunities across Victoria to encourage young people to engage with STEM. • The Victorian State of Engineering Report – highlights the value of the engineering profession for Victoria, and recommends the development of a strategic framework for STEM education, attracting more students to engineering, and increasing industry engagement with those undertaking STEM education.
WA	<p><i>Future Jobs, Future Skills</i>, launched in 2018, is an integrated strategy for driving STEM skills across Western Australia, which includes a focus on education in addition to an industry and community-based approach. The strategy includes \$3.3 million in funding for new initiatives, in addition to more than \$25 million in existing initiatives.</p> <p>The vision of the strategy is a globally competitive and innovative workforce with the skills to drive Western Australia's technological future and create new job opportunities. The strategy includes three goals: ensuring students have STEM skills for the jobs of the future; reskilling the current workforce with STEM skills required to embrace a technological future; and breaking down barriers and ensuring that everyone has the opportunity to participate in a STEM future.</p>	<ul style="list-style-type: none"> • The development of a state-wide campaign to encourage the take-up of STEM careers. • Converting classrooms in 200 schools to science laboratories. • <i>STEM Innovation Partnership</i> – teacher development initiative on innovative STEM education practices. • <i>The Leap</i> programme – provided supplementary training in secondary STEM education to teachers. • <i>Exploring STEM at home</i> – resources for parents to assist with activities and ideas to support their children's learning. • <i>The STEM Learning Project</i> – aims to increase students' interest, enjoyment and engagement with STEM by providing resources to support teachers to implement and extend the WA curriculum and develop general capabilities. • <i>The STEM Education Consortium</i> – a collaboration between the Education Computing Association of WA, the Mathematical Association of WA, the Science Teachers Association of WA and SciTech to provide leadership and support to promote STEM education to WA schools. 	<ul style="list-style-type: none"> • <i>Science and Innovation Framework 2018-22</i> – launched in 2018, the framework aims to build competitive advantages in WA and focuses on priority areas that can help enrich lives, create jobs and diversify the economy. Priority areas include building the State's capabilities in advanced and digital technology, and promoting the importance of STEM by preparing the current and future workforce with skills required to embrace a technological future. • <i>Women in STEM and Trades Pledge</i> – encourages WA businesses, community organisations, public sector agencies and individuals to support training and career opportunities for girls and women. • Digital and Technology Skills programme – awards grants to WA STEM education providers to deliver projects that increase skills or engagement from students, and people in the community including the existing workforce who are under-represented in STEM. • SciTech – a not-for-profit organisation supported by the WA Government that seeks to increase awareness, interest, capability and participation in STEM. SciTech's 2018-2020 strategy aims to equip WA with the 21st century skillset needed in the future through a range of programmes, exhibitions, regional tours and teacher development initiatives.

65 Tasmanian Department of Education, [STEM Framework \(2017\)](#)

66 Tasmanian Department of State Growth, [A stronger training system – investing in skills for jobs \(2018\)](#)

67 Victorian Department of Education and Training, [VicSTEM: STEM in the Education State \(2016\)](#)



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