ENGINEERS
AUSTRALIA

sySTEMic Collaboration

2019 AUSTRALIAN EDUCATION AWARDS WINNER BEST STEM PROGRAM

Best STEM Promoter 2019 AISA AWARDS

2018 & 2019 Report:

2020 Forward Planning

What is the sySTEMic Collaboration?

The sySTEMic Collaboration involves the establishment of long-term partnerships between industry, schools and tertiary education providers, aiming to increase the number of young people achieving a post-school STEM-related qualification while helping to prepare students for the world beyond school at a time in their lives when they are making decisions that will influence their career path.

Other aims include increasing the number of young people achieving a post-school STEM-related qualification and strengthening their employment prospects in the pipeline of STEM-required industries.

The program has a particular focus on encouraging and supporting young people from groups that are under-represented in STEM such as Indigenous young people, women and those from disadvantaged backgrounds.

Why was the sySTEMic Collaboration model chosen?

The sySTEMic Collaboration model is in response to the 2017 Engineers Make Things Happen report, which highlights the critical need for industry and education collaboration for the future benefit of the community.

If Australia is to become an innovative nation, our engineering capability must expand. This should be done by reducing reliance on skilled migration and producing a greater number of home-grown engineers.

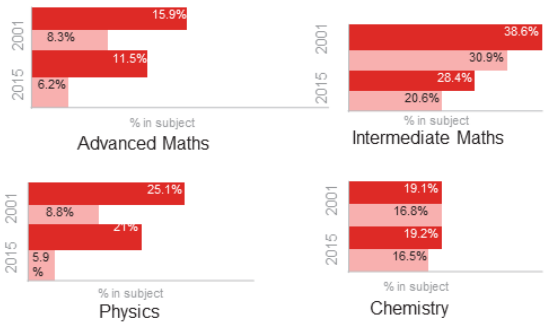
Mathematics and science are the tools used by engineers to solve real world problems. For engineering, participation in high school STEM subjects is a vital means to an end - but research has shown that there is a looming crisis: The percentage of students studying STEM is still dropping *(Source: 2017 Engineers Make Things Happen Report)*. In addition, there is direct connection between the low numbers of women in engineering and severe degrees of difficulty in attracting young women with required Year 12 advanced mathematics and physics backgrounds.

Furthermore, there is an education gap between Indigenous and non-Indigenous Australians. The proportion of Aboriginal and Torres Strait Islander 17–24 year olds participating in post-school education, training, or employment is 40 per cent, compared to the non-Indigenous rate of 75 per cent in 2012-13 (SCRGSP, 2014).

SUBJECT	Young men	Young women	Cohort
Advanced Mathematics	MODERATE	SEVERE	HIGH
Intermediate Mathematics	LOW	MODERATE	LOW
Physics	LOW	SEVERE	MODERATE
Chemistry	MODERATE	MODERATE	MODERATE

Left: The number of young women studying STEM subjects is alarmingly low.

Source: 2017 Engineers Make Things Happen Report



Right: The percentages for STEM subject participation in Australia.

Source: 2017 Engineers Make Things Happen Report

Northern Territory Government Involvement

The Northern Territory Government, through the Department of Education, is a major supporter of the sySTEMic Collaboration pilot. Reasons for their support include:

- Ensuring future generations of young Territorians have the skills for the 21st Century;
- The types of jobs that will be available in the future will require science, technology, engineering and mathematics (STEM) skills;
- Partnerships between schools and industry provide opportunities for students to engage with the world of work and better understand the relevance of their learning to jobs and career path.

Students and Curriculum

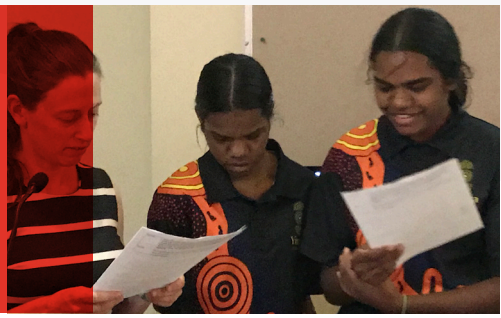
The benchmarks for the program are 50% females and 25% Aboriginal student participants.

An innovative curriculum was very important for the sySTEMic Collaboration to succeed. The teaching program created for the sySTEMic Collaboration is now listed under pre-approved Learning and Assessment Plan (LAP) for the South Australian Certificate of Education (SACE). This listing signifies that the program is considered best practice as it meets all the assessment and design criteria set out in the course outline. The LAP can be found on pp. 5-6 of this report. Furthermore:

- 17 students from Taminmin College took part in the 2018 pilot year of the sySTEMic Collaboration.
- 37 students from five schools across the NT took part in the sySTEMic Collaboration in 2019. Schools included Taminmin College, St. Phillips, Our Lady of the Sacred Heart, Centralian High School, and Yirara College.
- Each student participates in immersive site visits, a problem-solving day where innovative skills are required, and off-site excursions.
- Each of the student groups create their own project topic related to a relevant rural issue for their final presentations.
- Topics have ranged from turning rubbish into power, to digital locks, to recycling HDPE plastics and to de-humidifying households.
- The winners were awarded a scholarship to a STEM camp upon successful application.

Analysis and Feedback

Below: Students in Alice Springs presenting their findings.



Students learned to:

1. **Work collaboratively** to problem solve using an Engineering Design Process
2. **Develop** their creative and critical thinking skills, plus their personal and social skills
3. **Recognise** how engineering is used in the world
4. **Develop confidence** in pitching their ideas to an audience
5. **Discuss** their ideas with others and ask questions more

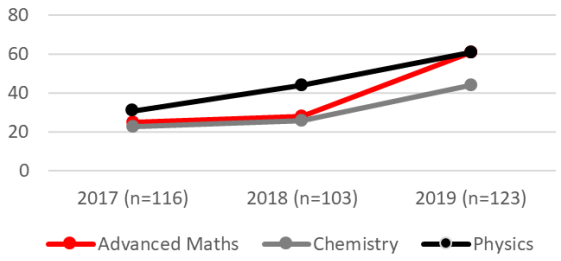
Enrolments in Advanced Maths, Physics and Chemistry increased dramatically at Taminmin College after the pilot year in 2018, with over 90% of the participating students in the pilot year requested a STEM-related work experience placement including placements with the industry mentors.

In all applicable categories, the number of students studying STEM subjects is well above the national percentage. 83.33% of the of the pilot females are studying a maths subject in year 12. In addition, the number of females studying chemistry in year 11 and 12 is well above the national figure, as is the number of females studying physics in year 11.

Breakdown by gender of subjects studied by sySTEMic Collaboration participants

Cohort	Gender	Maths	Chemistry	Physics
Alice Springs	Male	100.00%	83.33%	50.00%
	Female	100.00%	66.67%	50.00%
	Total	**100.00%**	**75.00%**	**50.00%**
Darwin 2019	Male	100.00%	42.86%	71.43%
	Female	100.00%	50.00%	25.00%
	Total	**100.00%**	**46.67%**	**46.67%**
Darwin 2018	Male	100.00%	33.33%	77.78%
	Female	83.33%	33.33%	0.00%
	Total	**93.33%**	**33.33%**	**46.67%**

Taminmin College STEM enrolments Semester 1 2017-19



Comparison of the percentage of Australian High School Students studying STEM with the sySTEMic Collaboration Cohorts

	Percentage of Australian High School Students studying STEM		% of Eligible sySTEMic Collaboration cohort		
	2001	2015	ASP 2019	DRW 2018	DRW 2019
Advanced Maths*	11.90%	8.70%	N/A	53.33%	N/A
Intermediate Maths*	34.50%	24.40	N/A	46.67%	N/A
Physics	16.50%	13.10%	50%	46.67%	46.67%
Chemistry	17.90%	17.80%	75%	33.33%	53.33%

*figures available for Year 12 only

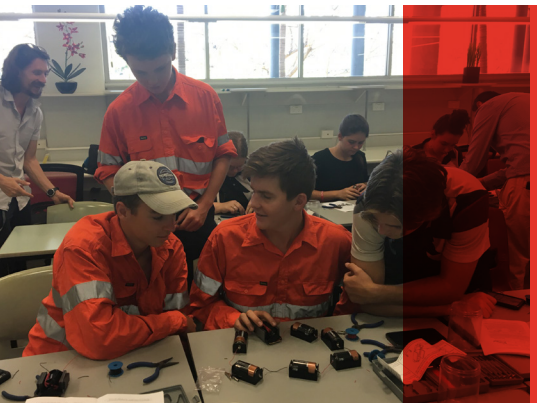
Analysis and Feedback

The sySTEMic Collaboration was named Best STEM Program at the 2019 Australian Education Awards.

The sySTEMic Collaboration was named Best STEM Promoter of the Year at the 2019 AISA Awards.

Feedback from students and industry partners has been overwhelmingly positive.

One quote from a student sums up the objective of the sySTEMic Collaboration, that regardless of any student's background, *"there is a place in engineering for everyone."*



Left: Students collaborate at an excursion to Darwin's Charles Darwin University.

"We are committed to ensuring future generations of young Territorians have the skills to equip them for the workforce of the 21st Century and Engineers Australia is to be commended for instigating this program to help boost employment pathways to our vital infrastructure fields."

"We know that investing in STEM programs is crucial for preparing our children for the jobs of the future, as about 75% of the fastest growing occupations require STEM skills and knowledge."

"The Northern Territory faces unique challenges and opportunities that engineering can solve in new innovative ways, however, we need more students to understand the importance of STEM subjects and how they can be applied in real life problem solving. Collaboration between industry and education allows students to experience the applications of engineering in the workforce, encouraging them to undertake STEM subjects and look towards a future of leading innovation and change in Australia."

Eva Lawler
Minister for Infrastructure, Planning and Logistics

Selina Uibo
Minister for Education

Keely Quinn
General Manager, Engineers Australia Northern

SACE BOARD
SOUTH AUSTRALIA

Pre-approved Learning and Assessment Plan

Stage 1 Integrated Learning

Pre-approved learning and assessment plans are for *school use only*.

- Teachers may make changes to the plan, retaining alignment with the subject outline.
- The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
- The plan does not need to be submitted to the SACE Board for approval.

School _____ Teacher(s) _____

SACE school code			Year	Enrolment code					Program variant code (A–W)
				Stage	Subject code			No. of credits (10 or 20)	
				1	I	L	N	10	

Addendum – changes made to the pre-approved learning and assessment plan

Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:

- what changes have been made to the plan
- the rationale for making the changes
- whether these changes have been made for all students, or for individuals within the student group.

Endorsement

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

Signature of principal or delegate _____ Date _____

Government of South Australia

Assessment overview

Stage 1 Integrated Learning – 10 credits

Program Focus (e.g. outdoor activities, cultural program): SySTEMic Engineering Program

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

Assessment Type 1: Practical Exploration – weighting 20%

Assessment details	Assessment design criteria			Assessment conditions (e.g. task type, word length, time allocated, supervision)
	AD	IR	CC	
Site Visit photo-journal and reflection: Students visit engineering industry sites and participate in problem solving days over the course of the program. During these STEM experiences students will explore how the Engineering Design Process is used to innovate solutions to real world problems. They will explore future STEM pathways and develop connections with industry through a mentoring program that will support them to complete their projects. Students will plan what information they are seeking during each STEM experience and take notes and photos which they will annotate, summarise and reflect on in their photo-journal. Students also have a discussion with their peers where they discuss their learning, the development of at least one or more capability/ies, and receive feedback from their teacher and peers.	1,3	2	2	Photo journal (or format negotiated with the teacher) and discussion Maximum 2, A4 pages including photos and annotations per experience To be submitted electronically Individual Due date to be negotiated

Assessment Type 2: Connections – weighting 60%

Assessment details	Assessment design criteria			Assessment conditions (e.g. task type, word length, time allocated, supervision)
	AD	IR	CC	
Students undertake a student-directed STEM inquiry project. They collate a Record of Evidence and undertake a Presentation: **Record of Evidence:** Students are to collate evidence of the inquiry process used to design a solution to the STEM problem they have chosen. This includes documenting evidence of the development of their general capabilities.	1, 2	1, 2	1, 2	Format to be negotiated with the teacher, multimodal evidence encouraged. Individual Due on the same day as the presentation
Presentation: Students are to present their idea and solution to an audience that includes peers, teachers, family and mentors from industry. This will also include sharing how they worked together as a group. They will answer questions posed to them by panel after the presentation.	1,2	1	1,2	Multimodal presentation Collaborative

Assessment Type 3: Personal Venture – weighting 20%

Assessment details	Assessment design criteria			Assessment conditions (e.g. task type, word length, time allocated, supervision)
	AD	IR	CC	
Industry and me: How has participating in a STEM program with an industry focus helped me? Focusing on their chosen capability and their experiences during the program, students are to produce a response to the question: How has participating in a STEM program with an industry focus helped me?	2,3	1,2	2	Format to be negotiated with the teacher, multimodal evidence encouraged. Individual Due date after presentation in AT2: Connections

Three or four assessments. Please refer to the Stage 1 Integrated Learning subject outline. Used with the kind permission of Taminmin College.