



STEM at St. Joseph's, Bardon

At St Joseph's, we pride ourselves in our rigorous approach to STEM Education. In addition to the in-depth content knowledge required for Science, Technology, Engineering and Mathematics, we prioritise connected and authentic learning experiences that develop skills for innovation, collaboration and creative and critical thinking. We encourage our students to be lifelong learners and responsible global citizens.

With digitalisation and automation continuing to rapidly and dramatically change the world of work, we can't predict many of the jobs that today's STEM students will hold as their careers unfold. But we can be certain that they will need deep discipline knowledge in their field, digital literacy and the flexibility to pivot their careers to embrace new challenges. A STEM education delivers these skills.

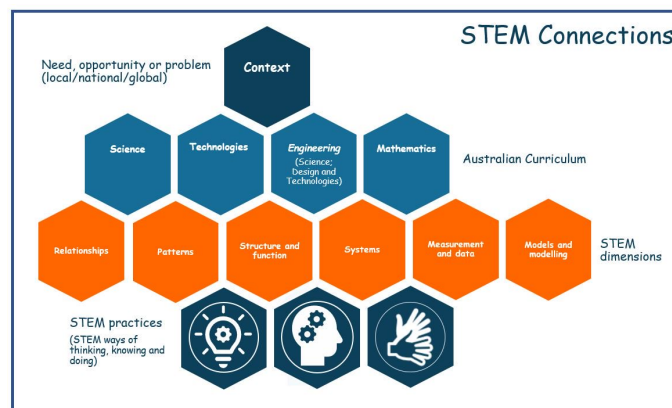
Dr Alan Finkel, AO Australia's Chief Scientist (2020 Australia's STEM Workforce Report)

Learning and Teaching

At St Joseph's, we engage our students in STEM through connected units of work. This aligns to ACARA's guidelines, as we:

- develop STEM practices (STEM ways of thinking, knowing and doing) by addressing the STEM dimensions (relationships, patterns, structure and function, systems, measurement and data, and models and modelling). These dimensions contribute to a holistic understanding of STEM, are reliant on each other, and provide the language for a conversation about STEM in the Australian Curriculum.
- develop a deep understanding of the concepts and processes of Science and Mathematics and their relationship to Technologies and Engineering
- use their knowledge, understanding and skills in response to identified needs, opportunities and problems from their communities (local, national or global)
- apply the general capabilities, Critical and Creative Thinking, and Ethical Understanding, to make informed decisions and choices when creating solutions for complex needs, opportunities or problems.

Figure 1 provides a representation of the elements of a STEM unit and its connections to the context, Australian Curriculum, STEM dimensions and STEM practices.



Source: <https://www.australiancurriculum.edu.au/resources/stem/>

The STEM dimensions include:

Relationships: an understanding of how ideas, things or events are related to one another; for example, how causality (one event or action is the direct result of another) or equivalence is crucial to problem-solving and designing solutions. This dimension underpins the other dimensions.

Patterns: an ability to recognise, describe, create and visualise patterns; make predictions based on observations; and see connections and make generalisations.

Structure and function: an understanding of how the physical or abstract form of objects, systems or processes (including sub-structures, organisation and hierarchy) relate to their function or purpose.

Systems: an understanding of how interconnected procedures and or components (objects, processes and concepts) are organised and work together, and the ability to abstract the relevant details of these systems according to the situation.

Measurement and data: an ability to collect and analyse information that provides insight, allows for formation of theories and influences design and iteration.

Models and modelling: a representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, *system* or idea; and the ability to create physical, mathematical or conceptual models that may enhance problem-solving.

Expert Teaching Team

St Joseph's has a STEM specialist teacher who works with students and classroom teachers to integrate STEM opportunities into learning and teaching across curriculum areas.

The role and responsibility of the STEM specialist teacher includes:

- Facilitating professional development for staff in STEM education
- Leading STEM education initiatives for students both in the classroom and during extra-curricular activities
- Partnering with community, government, and industry STEM professionals
- Collaborating with classroom teachers using a co-teaching cycle to co-plan, co-teach, co-debrief and co-reflect (Sharratt & Fullan, 2012) to build capacity and confidence in embedding STEM across the curriculum, as outlined in the table below.

Table 1: St. Joseph's STEM Co-Teaching Plan

	1 st year - 2020	2 nd year - 2021	3 rd year - 2022	4 th year - 2023	5 th year - 2024
STEM Learning Experience 1	Co-teaching cycle completed	Supported delivery	Independent delivery*		
STEM Learning Experience 2		Co-teaching cycle completed	Supported delivery	Independent delivery*	
STEM Learning Experience 3			Co-teaching cycle completed	Supported delivery	Independent delivery*
STEM Learning Experience 4				Co-teaching cycle completed	Supported delivery
STEM Learning Experience 5					Co-teaching cycle completed

(*Independent delivery would still involve collaboration with teaching partners and STEM specialist if required)

STEM Co-Teaching Plan:

- Co-planning with classroom teachers occurs in year levels throughout all phases of the implementation. This occurs in macro-planning sessions with the Primary Learning Leader and ST:IE, so that a connected approach to STEM education is embedded in teaching and learning cycles.
- Classroom Teachers are encouraged to repeat the learning experience the following year with reduced support from the STEM specialist teacher, and then again subsequent years aiming for eventual independent delivery.
- The STEM specialist teacher will continue to collaborate with the classroom teachers by introducing a minimum of one new STEM learning experience each year (Table 2), for the duration of the five year plan.

Based on the research of Hattie (2003) and Barber and Mourshed (2007), the flow-on effect should be increased student engagement and achievement in STEM. Hattie explains “when we see impact, then there is a virtuous circle where lessons are tweaked and changed to continue to maximise the impact. (PwC Australia, 2016, p. 3).

Connected STEM Opportunities for Students

Nomination Process:

- Teachers, ST:IE and PLL nominate students based on their Creativity, Inquiry skills, Maths & Science skills, Engineering-Design thinking, Critical thinking and collaboration skills. Students are also selected from data collection such as Standardised assessments, SRS data and NAPLAN data.



Brainways



BRAINways
EDUCATION
excellence through education

BRAINways EDUCATION programs provide opportunities for highly able and gifted students and are tailored for their special educational needs. BRAINways Education provide hands on learning experiences that are both interesting and challenging. The learning experiences allow students to engage in complex, abstract and problem-solving activities. Students engage in higher order thinking, analysis, and reflection. These days are held away from school. Selected students in Year 1 to Year 6 may enrol.

- Quest competition provides an opportunity to work as a team and develop leadership skills while gaining and understanding of complex topics.
- Days of Excellence programs are 2-day programs that are developed in response to the latest educational research in gifted education.
- Academicus are holiday workshops in Maths, Science and Humanities.

Gateways caters for children who are in the highly able range. Programs are pitched at an age level higher than the child's chronological age. These days are held away from school. Selected students in Year 1 to Year 6 may enrol.

- Eureka Program – a single day program based on a theme with 3 exciting workshops through the day.

STEM horizons



STEM horizons is a program for high achieving Year 6 students and is the perfect opportunity to enhance and extend science knowledge beyond the classroom. There are 4 full days of specialist activities. These days are held away from school. 4 students in Year 6 will be nominated.

Maths Games

Australian Problem-Solving Mathematical Olympiads (APSMO) games consists of 5 contests that are held 6 weeks apart. Students will develop important problem-solving skills. These days are held at school during the school day. Students in Year 3 to Year 6 will be nominated.

All Hallows Maths Tournament

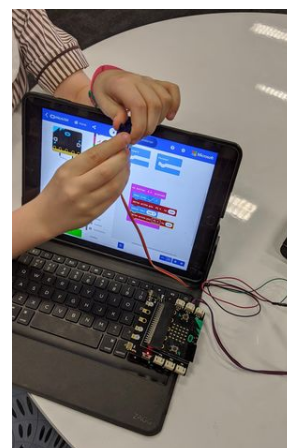
The tournament aims to provide a series of mathematical problems which will provide students with a high level of intellectual engagement. Students will have the opportunity to work cooperatively and creatively to solve a series of problems. The competition is held at All Hallows School. Students in Year 5 and 6 will be nominated.

Tournament of the Minds

TOM is an educational program challenging students, developing their problem-solving skills as well as their collaborative skills. Challenges are set in the following disciplines... The Arts, Language Literature, Social Sciences and STEM. Students in Year 3 to Year 6 are nominated to participate. The competition is held away from school.

BrainRaiders

BrainRaiders is an extra-curricular STEM program offered by St Joseph's in collaboration with the University of Queensland. The students involved (Year 3 – 6) attend weekly sessions to prepare entries into the Young ICT Explorers competition and the Brisbane Catholic Education STEM MAD (Make a Difference) competition. Entry into these competitions requires teams to follow a design thinking process to create technology-based solutions to real world problems. 15 to 20 students are selected for this program.



Young ICT Explorers (YICTE)



Young ICT Explorers (YICTE) is a non-profit competition, created by [SAP](#), supported by CSIRO Digital Careers and The Smith Family with the help of Industry and University partners across Australia to encourage primary and high school students in years 3-12 in Australia and New Zealand to solve real-world problems or showcase their passions using technology.

<https://www.youngictexplorers.net.au/>

STEM MAD (Make A Difference)



This competition involves 15 Catholic Dioceses from across Australia to 'Make a Difference' in our world through STEM innovation. The competition culminates in a showcase that is designed to acknowledge and promote STEM learning initiatives that address real-world problems. It demonstrates how students in Catholic schools take action that matters, by designing a service, product, or innovation to **make a difference** (MAD) to others or the environment.