

INSPIRE CONNECT LEAD 2013-2018



**STEM HIGH SCHOOL
ENGAGEMENT**

OVERVIEW AND IMPACT REPORT 2013-2018



Foreword

To enable our country to thrive in the future, it is imperative that we enhance the perception and the relevance of STEM education. With 75% of the fastest-growing occupations requiring STEM skills, there is an acute and pressing need to foster the development of future STEM leaders in Australia who will contribute meaningfully to our economy. At QUT, we are passionate about working closely with industry, government and other institutions in striving towards our goal of creating the next generation of STEM-qualified individuals.

QUT's STEM High-school Engagement Strategy demonstrates our ongoing commitment to this goal. Since 2013, we have invested over \$4.3 million in the delivery of this strategy that is strongly aligned with the Australian Chief Scientist's directive to attract and retain students in STEM degrees.

This report outlines QUT's unique and leading approach to engaging high-school students and influencers across a wide variety of STEM touchpoints. Ongoing monitoring and evaluation of the program has been conducted to measure its impact, and QUT is releasing this report to present the outcomes of this work. Importantly, we wish to share the approaches that we think have affected the greatest results with a view to improving practice and to foster the necessary partnerships to continue to effect change for the future.

From our world-class Science and Engineering Centre and the Cube, to our designated STEM classroom space, STEM Teacher in Residence program and our industry partnerships, QUT is leading the way in creating the next generation of engaged and future-ready participants in the real world of tomorrow.

Leanne Harvey

Vice-President (Administration) and University Registrar
QUT



Essence of Our STEM Strategy

How QUT is helping build a future with STEM.

A unique approach to engaging school students and their teachers that goes far beyond the classroom. We **inspire**, **connect** and **lead** to grow the next generation of science, technology, engineering and mathematics (STEM) leaders in Australia.



Inspiring students and teachers about the power and possibilities of STEM.

QUT's STEM Engagement Strategy engages school students across a diversity of background, gender, academic level and geographical location. Our leading combination of cross-disciplinary, project-based and hands-on learning experiences become a catalyst that brings the STEM curriculum to life - both in and beyond the classroom. We encourage students' curiosity about STEM and its employment pathways. We also support teachers' passion for real-world STEM learning, equipping them with additional knowledge and tools to positively influence their students' attitudes to STEM.



Forging connections between students and STEM in the real world.

QUT's STEM Engagement Strategy is founded on the principles set out in the National STEM School Education Strategy, aligned with the global focus on STEM literacy, and mapped to the national education curriculum. Our program connects students in multiple ways with world-leading university STEM facilities, student ambassador peers, real-world industry partners and ground-breaking STEM research. These practical, hands-on and inspiring connections enhance the relevance and importance of STEM in students' future career choices.



Leading transformational change in STEM school engagement.

QUT's STEM Engagement Strategy leads the way in creating real-world STEM opportunities for school students. Our comprehensive program of STEM-related touchpoints throughout primary and secondary school increases the accessibility of university to these students. Exposing them on multiple levels to new knowledge and the real-world application of STEM builds interest in this as a relevant and aspirational career that is within their reach. QUT academics are at the forefront of innovative STEM teaching and learning, actively shaping the national STEM curriculum, and directly inspiring students through hands-on education.



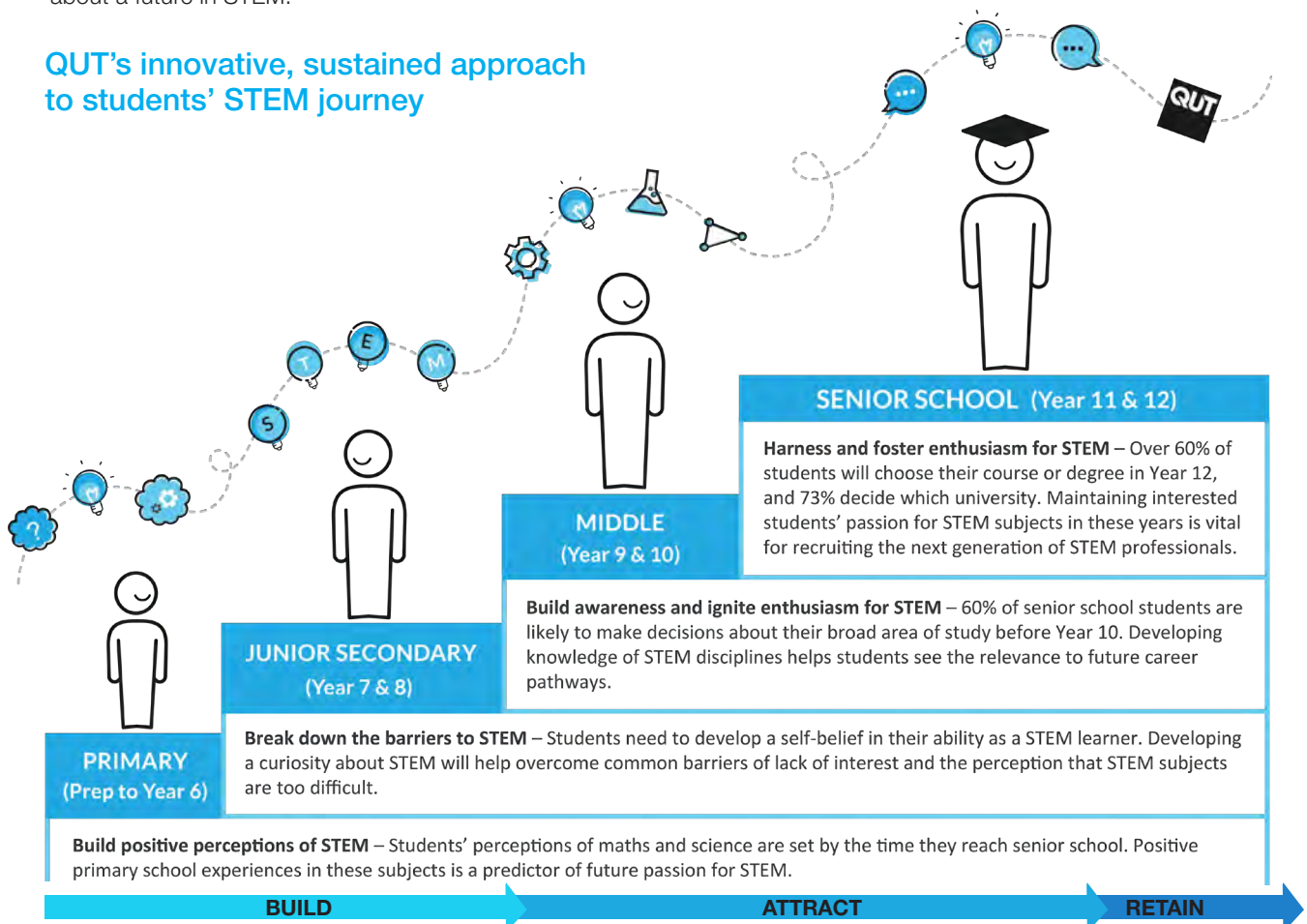
Touchpoint Journey

True impact comes from students having several STEM related experiences.

The frequency and timing of STEM engagement activities has a significant impact on students' initial perceptions of STEM and students' decision-making process for senior subject selection. Universities play an important role in driving student interest in STEM subjects by offering multiple STEM-related experiences throughout their primary and secondary schooling.

QUT's STEM Engagement Strategy delivers a broad range of programs targeting students of all ages. From free visits for primary school students to the awe-inspiring Cube, through to curriculum-aligned events for students in grades seven to 12, QUT's program of touchpoints aims to challenge perceptions and be a catalyst for curiosity about a future in STEM.

QUT's innovative, sustained approach to students' STEM journey



Build positive perceptions of STEM – Students' perceptions of maths and science are set by the time they reach senior school. Positive primary school experiences in these subjects is a predictor of future passion for STEM.

Break down the barriers to STEM – Students need to develop a self-belief in their ability as a STEM learner. Developing a curiosity about STEM will help overcome common barriers of lack of interest and the perception that STEM subjects are too difficult.

Build awareness and ignite enthusiasm for STEM – 60% of senior school students are likely to make decisions about their broad area of study before Year 10. Developing knowledge of STEM disciplines helps students see the relevance to future career pathways.

SENIOR SCHOOL (Year 11 & 12)
Harness and foster enthusiasm for STEM – Over 60% of students will choose their course or degree in Year 12, and 73% decide which university. Maintaining interested students' passion for STEM subjects in these years is vital for recruiting the next generation of STEM professionals.

MIDDLE (Year 9 & 10)

JUNIOR SECONDARY (Year 7 & 8)

PRIMARY (Prep to Year 6)

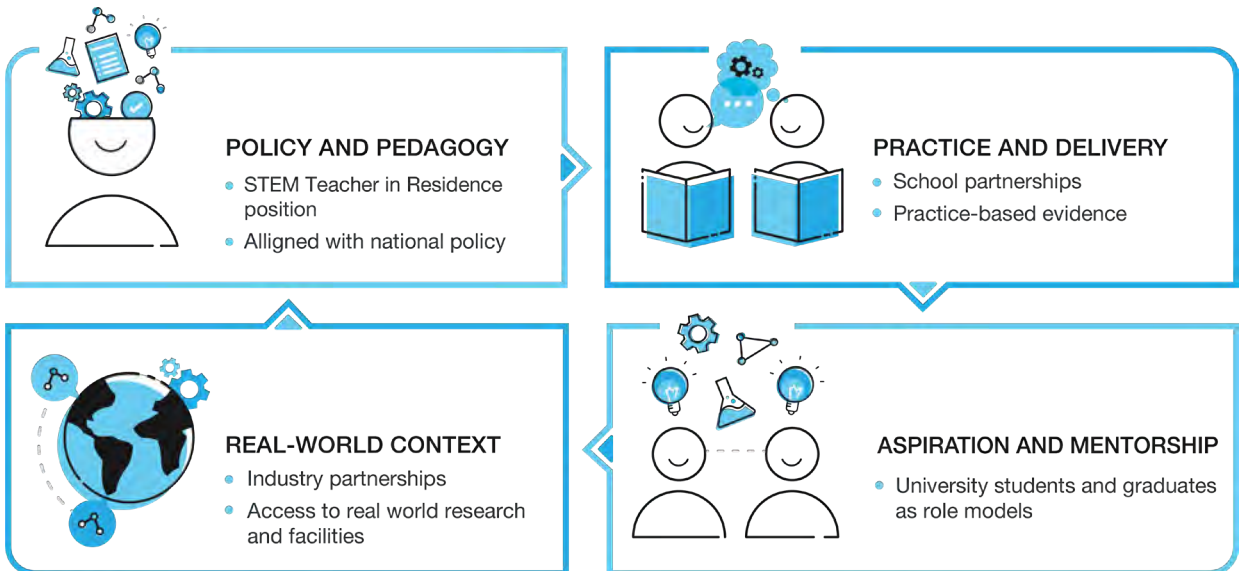
BUILD

ATTRACT

RETAIN

Ecosystem Approach

The 4 pillars driving STEM education success.



Policy and pedagogy

Our STEM Engagement Strategy is closely aligned with the National STEM School Education Strategy and the national education curriculum, ensuring that our goals and achievements are benchmarked against national policy. QUT's STEM Teacher in Residence drives relevant, inspirational and real-world content for the classroom.

Real-world context

QUT's established and successful industry and community partnerships shape our core programs and connect our students to groundbreaking real-world STEM research. Our program of highly engaging hands-on learning experiences ignite students' enthusiasm to tackle real-world challenges and teaches them a broad range of skills required to meet the needs of tomorrow's workplace.

Practice and delivery

QUT has built successful partnerships with schools across metro and regional Queensland. Our unique program of individual and multi-school workshops connects students with inspirational STEM learning experiences in a world-leading campus. Our strategy also enhances teachers' capacity and passion for STEM education.

Aspiration and mentorship

Our Student Ambassadors, graduates and student clubs play a vital role in inspiring high-school students about the possibilities of STEM. Direct interaction with these role models through hands-on learning opportunities and peer-to-peer mentoring builds student interest in STEM and curiosity about career pathways.



PROGRAM ELEMENTS

STEM Ambassadors

Each year, QUT selects and employs 50 current undergraduate students as STEM Ambassadors who form an integral part of the delivery of the program. The Ambassadors act as role models and peer-to-peer mentors for high-school students, inspiring this next generation about the possibilities of STEM. They engage directly with students in a range of activities, including facilitating workshops, and delivering presentations and campus tours. By sharing their own passion for studying STEM, their journeys and their future career goals, Ambassadors break down the barriers to STEM, making it more accessible, exciting and aspirational to high-school students.

Practice and delivery

QUT's STEM Ambassadors give students the opportunity to:

- See and hear first-hand how passionate real university students are about studying STEM and planning for their STEM career
- Work alongside these mentors solving real-world challenges in workshop activities
- Find out about the transition from school to university
- Engage in meaningful and hands-on learning experiences that extend their STEM understanding

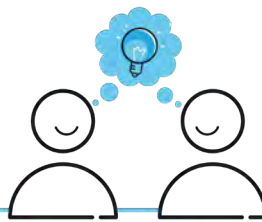


Impact



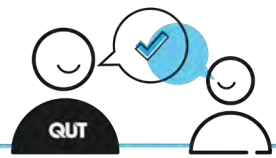
99%

High-school students who attended QUT's Vice Chancellor's STEM Camps enjoyed working with academics and undergraduates.



70%

Students who attended QUT student workshops viewed Student Ambassadors as inspirational.



89%

High-school students who attended the QUT's Vice Chancellor's STEM Camps found Student Ambassadors extremely approachable.



“ Being involved in delivering workshops at events is empowering for not only the school students, but also for us as ambassadors. It's incredibly inspiring knowing that what we're doing today is diversifying the future of STEM, our world. ”

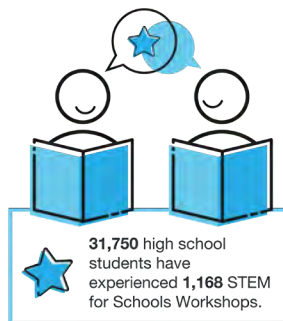
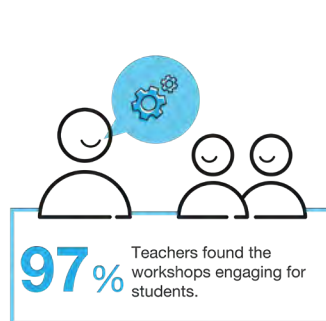
THIRD YEAR ENGINEERING STUDENT AMBASSADOR

STEM for Schools Workshops

This comprehensive program of free, curriculum-mapped STEM workshops is designed for students and their teachers in years 7-12. Held in QUT's Science & Engineering Centre, each workshop brings together all four STEM disciplines to offer students hands-on, practical and highly engaging learning experiences. Students collaborate with each other, our Student Ambassadors and STEM experts to design, build, test and evaluate solutions to real-world problems.



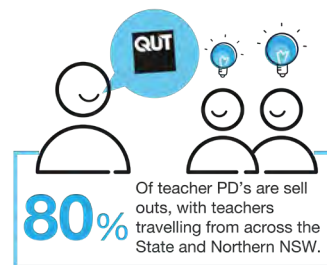
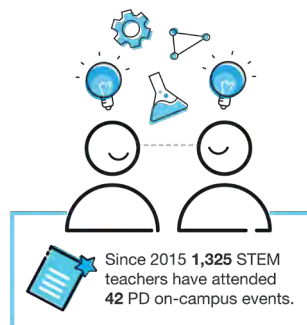
Impact



STEM Teacher in Residence

Unique to the program is its leadership position, the STEM Teacher in Residence, which is staffed by a highly-regarded senior educator with extensive teaching experience in school environments and with education policy. The position ensures the priorities of school institutions, teachers, students and government is driving the curriculum and pedagogy of the STEM for Schools program.

Impact



On-campus Multi-school Events

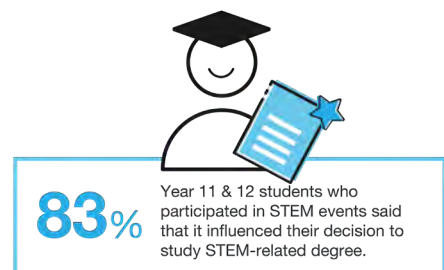
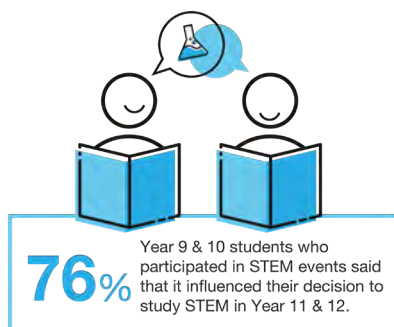
QUT has a long history of delivering events that have played a vital role in developing positive perceptions about studying STEM. This program of events comprises the Science and Engineering Challenge, Girls in IT and Games events and a range of full-day immersion programs. It correlates closely with the known critical touchpoints that influence a student's decision-making process about a future in STEM. Events held for students in Year 9 and 10 are designed to spark their interest in STEM at the time when they are making their senior subject selection. Events targeting Year 11 and 12 students are designed to build their awareness of STEM career options at the time when they are selecting their tertiary course and university.

Practice and delivery

STEM events give students the opportunity to:

- Engage in exciting, hands-on and enquiry-based STEM learning experiences that increase the relevance and value of STEM to everyday life
- Work with diverse role models and mentors who inspire them about STEM study and career options
- Tackle real-world problem-solving activities that enhance their curiosity about STEM
- Solve inspiring and complex challenges that increase their STEM skills and knowledge

Impact



QUT's STEM aspirational and experiential events include:

- AMSI ChooseMaths
- Applied Maths Seminar
- Australian Youth Aerospace Forum
- Engineering Link Project
- F1 in Schools State Final
- Girls in IT and Games
- National Youth Science Forum
- Power of Engineering
- QMEA Energy for the Future
- RACI Titration Competition
- Real Research Internships
- Science and Engineering Challenge
- Science Experience
- #spatialrealworld



Vice-Chancellor's STEM Camp

For the last five years, QUT's Vice-Chancellor's STEM Camp has been offering a unique opportunity for Queensland's brightest students, regardless of location, culture or background. The camp is held annually over five days in the September school holidays. High-achieving Year 11 students throughout Queensland are invited to attend Garden's Point campus to accelerate their understanding of STEM through hands-on exposure to current research and innovation. Students work directly with leading QUT scientists on a real-world research project. This fully funded opportunity is offered to 80 Brisbane students, and 80 regional and coastal students.

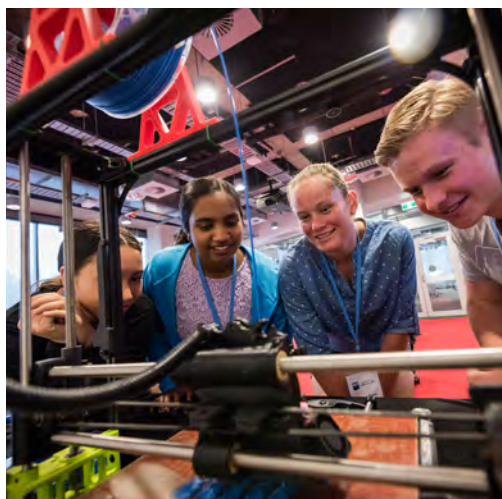
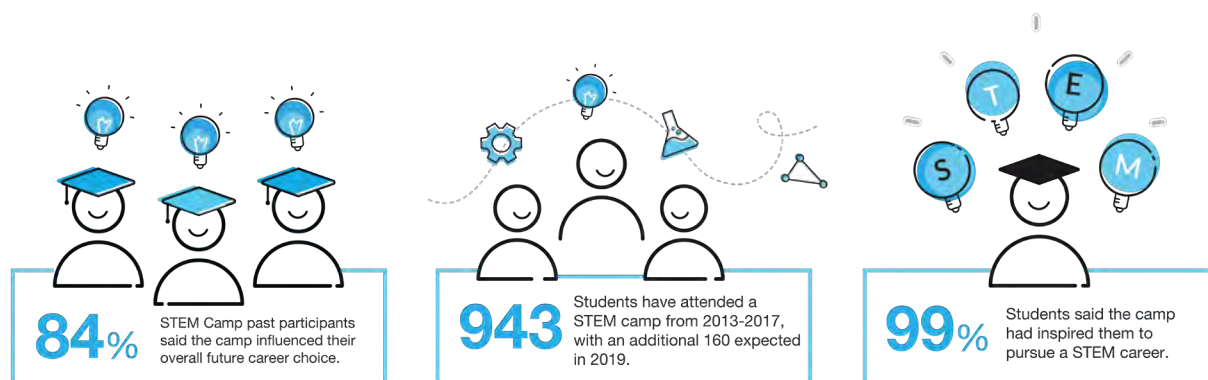


Practice and delivery

The Vice-Chancellor's STEM Camp gives students the opportunity to:

- Be mentored by QUT Student Ambassadors in exploring STEM pathways and career options
- Collaborate with like-minded peers with similar interests
- Extend their STEM learning and passion through real-world projects and presentations
- Gain first-hand exposure to a leading university campus with dedicated STEM facilities

Impact



Scientists as Educators

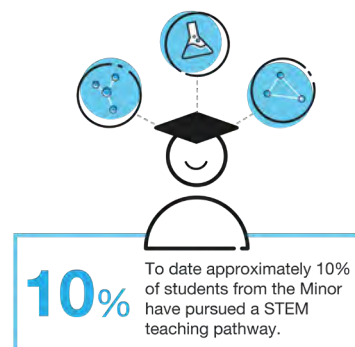
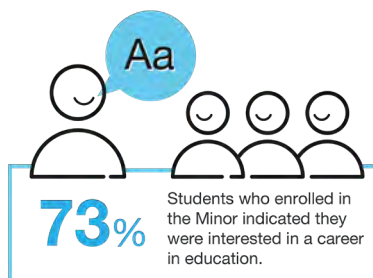
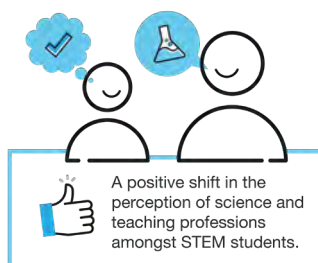
To help address the critical shortage of qualified secondary Science and Mathematics teachers, QUT developed the Science and Mathematics Education Minor as a STEM teaching pathway. This Minor gives first or second year Science, Engineering and Mathematics students an authentic introduction to teaching and comprises four units studied over two years. It offers students an innovative transition pathway to increase their potential as STEM educators, and to promote STEM teaching as a viable, fulfilling and in-demand career option. Since 2015, 149 students have undertaken this Minor, enhancing their communication and education skills, and inspiring them to consider STEM teaching in the future.

Practice and delivery

The STEM Education minor gives undergraduate students the opportunity to engage in:

- Practical teaching-related opportunities and skills that have developed their potential as educators
- Contemporary and multi-disciplinary subjects that explore collaborative learning approaches
- Learning that expands their communication skills to enable them to articulate research and effectively convey complex scientific and mathematical ideas to others
- Inspiring and interactive activities that deepen their own understanding of STEM

Impact





Partnerships

QUT has established strong and successful partnerships with a broad range of external stakeholders. This program of collaboration has been vitally important to the implementation and delivery of our STEM High School Engagement Strategy. Linked by our common goal of increasing students' understanding of, and interest in, STEM careers, the involvement of industry, government, professional association and community partners has ensured that QUT's strategy is underpinned by real-world applications.

Practice and delivery

Collaboration with our key partners give students the opportunity to:

- Be exposed to relevant and inspiring real-world STEM careers
- Connect the concepts explored in our programs to real-world applications
- Experience programs that are linked to current and future workforce requirements
- Give students the opportunity to go beyond stereotypes and understand the breadth of STEM skills

Impact



From 2013 to 2018:

- 3 x Government partners
- 4 x Professional associations
- 6 x Community partners



28%

Since 2013, we have increased our industry engagement. We now engage with 42 Industry partners.



Key partner collaborators include:

Industry and professional associations -

- Australian Mathematical Sciences Institute (AMSI), ARUP, Bligh Tanner, Boeing, Dimension Data, Engineers Australia, Field Orthopaedics, Caltex, Cook Medical, Flight Centre, SEQ Water, Suncorp, Telstra, Transport and Main Roads (TMR), Urban Utilities

Government and community -

- Education Queensland, The Engineering Link Group, Office of the Queensland Chief Scientist, Office of Chief Scientist (Australia), Spatial Information Council, Tech Girls are Superheros, Wonder of Science, World of Drones Education

Secondary Schools and Gateway to Industry Schools programs -

- QLD Government, Private, Home, Interstate, International, Queensland Minerals and Energy Academy (QMEA), Aviation Gateway, Manufacturing and Engineering



The Impact

Since 2013 we have delivered...



46%
females attended STEM activities

Provided access to opportunities for students and teachers across Queensland and Northern NSW



96%

STEM Camp students pursued studies into a STEM degree

84%
STEM Camp students scored



1,938

Teachers, guidance counsellors and principals engage via quarterly electronic direct mail

83%

First year STEM students said a QUT STEM activity

INFLUENCED



their decision to study a STEM-related degree

Female engineering numbers have increased from 11% in 2011 to **20%**

Increase of OP1-5 students studying Science and Engineering Faculty degrees



7% 2018

3% 2017



30% 2018

24% 2017

QUT FIRST PREFERENCES

BACHELOR OF IT

BACHELOR OF ENGINEERING

#1

#1

#1

63,553

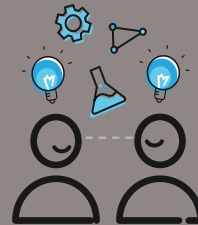
Unique STEM engagement experiences.



increased participation by

51%

of high school students and teachers over six years

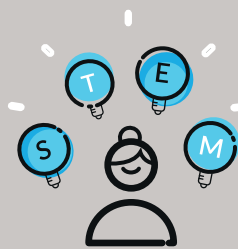


31,750

students experienced

1,168

STEM workshops



21,185

students experienced

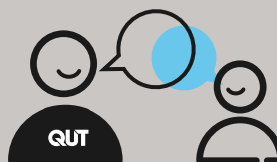
208

STEM events



540

Student Ambassadors employed to increase young people's engagement in STEM



24,427

hours of face-to-face contact with a Student Ambassador



Real-world impact

Himanthi Mendis, Civil Engineer

“ My STEM journey with QUT started when I attended the 2013 STEM Camp. The camp brought my school subjects to life and I fell in love with the concepts of engineering.

I was inspired to know more and attended the Engineering Link Project at QUT in Year 12. I met real engineering students who challenged my traditional perceptions of what an engineer did and looked like and I knew I wanted to be one of them.

Because of the mentorship at the camps, I applied for and received a Women in Engineering and Vice-Chancellor scholarship and went on to become the President of the Girls in Engineering Making Statements student club.

Through these roles, I was able to give back to high school students just like me, delivering Power of Engineering events in Brisbane and Caboolture and STEM camp.

I am now a Civil and Water Engineer for a local consulting firm and am so glad that my career in STEM brings new challenges, learnings and opportunities every day.

I believe in the impact of QUT's STEM experiences for school students and look forward to sharing my journey with the next generation.”

CASE STUDY

Power of Engineering



Power of Engineering details

When

Held four times a year

Where

QUT's Gardens Point campus, and regional centres, including Mount Isa, Cairns, Dalby, Roma and Chinchilla

Who

Up to 120 female students from Year 9 and 10 attend each event

Costs covered

All workshops, materials and transportation to and from site visits covered by QUT

What students loved most

- The specific workshop activities
- The interactive nature of the workshops, and being challenged
- Learning more about engineering
- Learning about study options and future careers

“ We have seen a significant increase in our students studying STEM in the senior school. ”

TEACHER, KELVIN GROVE STATE COLLEGE

Leading a positive mindset change by extending the relevance and appeal of STEM subjects to female students

Power of Engineering Inc is a not-for-profit organisation, formed by QUT, Engineers Australia and AECOM, that aims to inspire non-traditional students, especially females, to consider a career in engineering. QUT POE events are designed specifically for female students in Year 9 and 10, and their teachers. Timed prior to senior subject selection, these innovative full-day events are held at QUT's Gardens Point campus, and key regional Queensland locations. They combine a series of workshops with a site visit to an industry location, helping students realise the diversity and creativity involved in an engineering career.

What students experience

The events are delivered by female undergraduates from QUT student group, GEMS (Girls in Engineering Making Statements). Students participate in interactive, hands-on workshops where they define a problem, generate ideas and implement a solution. The afternoon site visit is an integral part of the program, exposing students to career journeys of female engineer role models who provide a positive real-world context to the engineering profession. The program has achieved outstanding support from industry, government and education stakeholders, with site visit locations of ARUP, Brisbane City Council, Qantas Engineering, Seymour Whyte, Boeing, Cook Medical and SEQ Water, among others.

A significant impact on STEM subject selection

Since 2012, QUT has delivered 33 different POE events in Brisbane and regional Queensland. A total of 2,808 students have participated, and 50 unique site visits have been offered. Schools who have participated in POE have reported a marked increase in the number of female students choosing senior STEM electives. In one all-girls' Brisbane high school, the number of students choosing Physics in Year 11 more than doubled increasing by 127%. A Gold Coast all-girls' high school reported a 63% increase in students choosing Engineering Technology, while a co-ed north-Brisbane college saw a 700% increase in females enrolling in Physics.



SAVE THE WORLD

BECOME AN ENGINEER

“ I enjoyed learning how to use different skills, and how we can use different careers to make a difference in the real world. ”

YEAR 10 STUDENT

“ I loved the different students all having input into the whole thing. It made everything about engineering seem so much more interesting. ”

YEAR 10 STUDENT

THE POWER OF ENGINEERING
CREATE YOUR FUTURE



52%

of students said the event improved their understanding of engineering by a great deal

92%

of students were satisfied with the information provided

62%

of students participated because they wanted to learn more about university

98%

of students enjoyed the POE event

74%

of students participated because they wanted to learn more about what engineers do

“ I really enjoyed the workshops, but they also challenged me. It was great that we got to be creative and learn about engineering, even though we're only year 9. ”

YEAR 9 STUDENT

CASE STUDY

STEM Workshops Program

STEM workshop details

When

Held on 135 days a year during term time

Where

QUT's Gardens Point Campus, in a dedicated education space housed in the Science and Engineering Centre.

Who

An average of 22 students from Queensland and Northern NSW high schools attend each workshop

Costs covered

All workshop resources and materials supplied by QUT

What students loved most

- The specific workshop activities
- The opportunity to extend their STEM learning
- Being mentored by Student Ambassadors
- Experiencing the university campus and facilities
- Learning about real-world STEM careers

“ This workshop is the best STEM workshop our school has ever attended. The students were highly engaged the whole time. ”

TEACHER, IPSWICH STATE HIGH SCHOOL

Connecting students to a future in STEM through real-world learning experiences

QUT's STEM workshops program comprises a series of fully funded educational workshops that are mapped to the national curriculum. Groups of Queensland students and their teachers from years 7 – 12 attend either half-day or full-day STEM intensives that are based on current QUT research and undergraduate course work. The workshops are held in a dedicated educational space within our Science & Engineering Centre, and each group can also choose to participate in a free 30-minute interactive experience at The Cube.

What students experience

The workshops focus on extending students' STEM knowledge by applying it to design, build, test and evaluate solutions to real-world problems. The students engage in hands-on, practical learning experiences that are led by QUT Student Ambassadors and academic STEM experts. The activities are modelled on the way university-level content is taught, and include topics such as launching a virtual rocket, using robots in a variety of challenges, and analysing real data to learn about environmentally friendly buildings.

Demand for workshops exceeding capacity

From 2013 to 2018, 1,168 curriculum-mapped workshops have been delivered to more than 31,750 high school students. 191 schools have engaged in the program. Since 2016, the workshops have reached booking capacity by Term 1, with a large number of schools placed on a waiting list. 2019 workshops were booked out before the end of Term 4, 2018. The dedicated educational space housed in the Science and Engineering Centre on-campus has been instrumental to the success of the program by facilitating delivery and exposing students to an aspirational, world-leading learning environment.



“ Very well presented. The Ambassadors were very easy to talk to and get to know. They gave us insightful knowledge about choosing our future careers. ”

YEAR 9 STUDENT

“ I was able to learn about coding in a practical, hands-on way. I can now take this knowledge and continue learning about it in my own time and at school. ”

YEAR 12 STUDENT

97%

of teachers found the workshops engaging for students

94%

of teachers found the content useful for future classroom activities

85%

of students said they enjoyed the workshop activities they participated in

92%

of students said they had learned something new

74%

of students would consider study at QUT

“ This has changed how I feel about university. I definitely want to come here now. ”

YEAR 9 STUDENT

CASE STUDY

Vice-Chancellor's STEM Camp

Vice-Chancellor's STEM Camp details

When

Held over five days in the September school holidays

Where

QUT's Gardens Point campus

Who

160 students each year – 80 from local Brisbane schools, 80 from regional schools. Year 11 applicants must have achieved at least two VHAs in a Science, Mathematics B or C, Engineering Technology or Computer Science

Costs covered

All travel, accommodation, meals and materials are covered by QUT

What students loved most

- Meeting like-minded peers with similar interests
- Being mentored by academics and Student Ambassadors
- Extending STEM learning and passion through real-world projects
- Experiencing the university campus and facilities
- Learning about real-world future careers

Inspiring Queensland's brightest students about a future in STEM

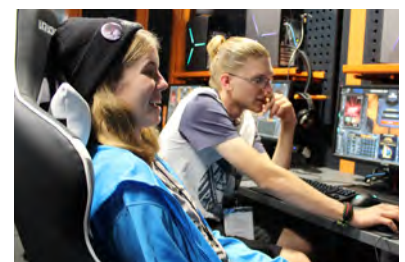
The STEM Camp is a fully funded, five-day event targeting high-achieving year 11 students from both regional and local Queensland schools. To address the shortage in the STEM pipeline, the camp offers an engaging and challenging experience for these students, regardless of location, culture, gender or background. Highly interactive and hands-on, it accelerates students' understanding of research and innovation in STEM, and magnifies their exposure to degrees and careers in STEM fields.

What students experience

Students work on team-based challenges tackling global issues related to energy, food, the environment, IT and security. Each real-world project is led by a key QUT academic, giving students the opportunity to experience groundbreaking research as it happens within our world-class research facilities. The students must apply their collaborative, creative, investigative and problem-solving skills to address these challenges, and they are mentored throughout the five days by QUT Student Ambassadors.

Overwhelming interest that keeps growing

First held in 2013, the camp has become a high-profile and extremely successful annual event with a very high level of student satisfaction. 943 students have attended a camp, with a further 160 expected later this year. This event attracts significant attention from government, industry and media, with visits from the Chief Scientist, the Queensland Premier and Education Minister, and Boeing's Managing Director. Facebook engagement has reached in excess of 150,000 people.



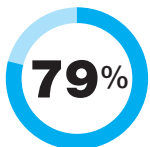
“ A PHENOMENAL experience providing me with invaluable insight into university, research and the application of what is studied in the real world. ”

“ I did research with one of the top researchers at QUT in biotechnology. He made me curious about this incredible field of science. ”

“ The camp helped confirm that STEM was the right field for me to study. It was a great eye opener for university life and what QUT has to offer. ”



Strongly agree: Did the camp influence your overall future career choice?



Strongly agree: Did the camp inspire you to solve the world's problems?



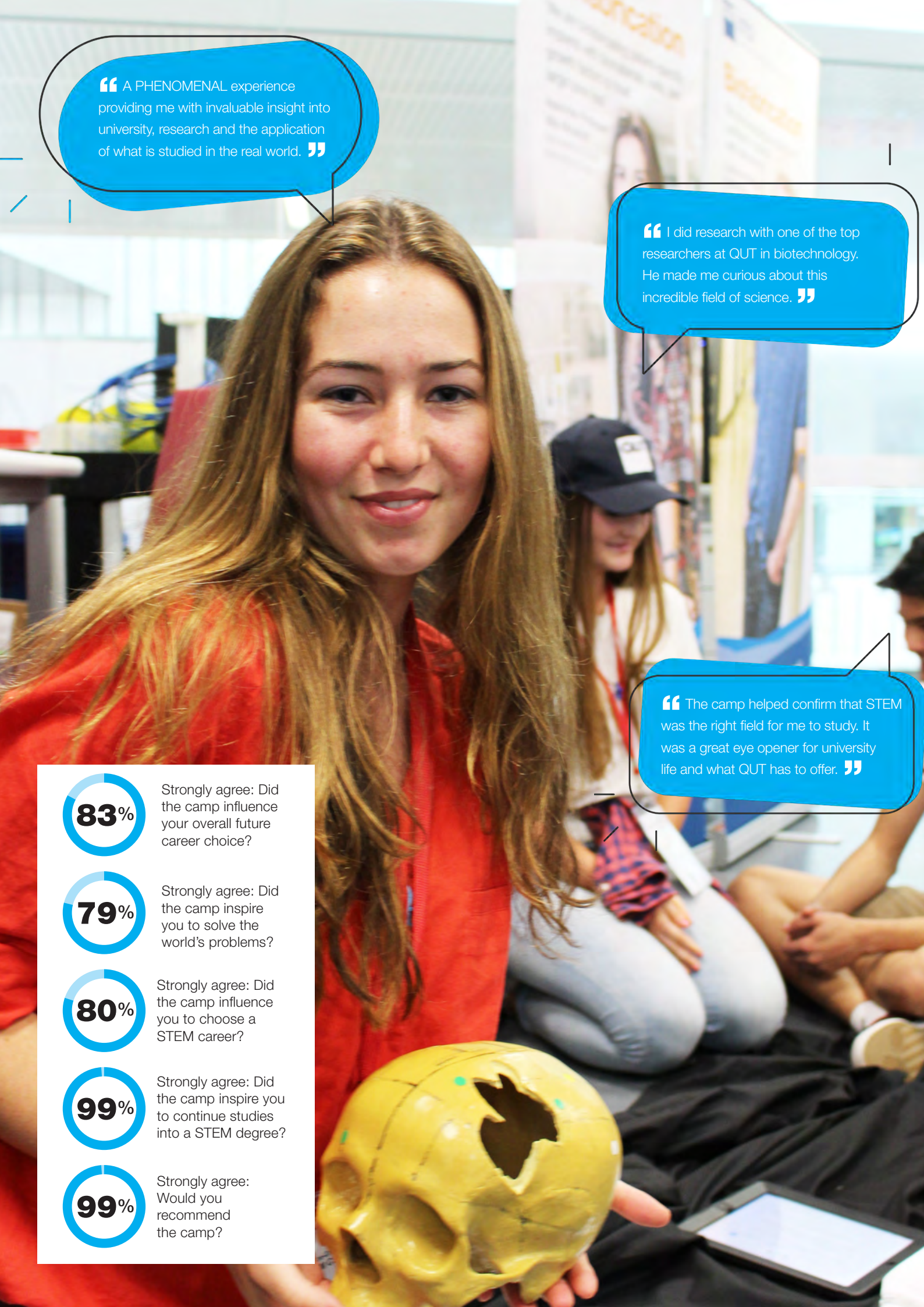
Strongly agree: Did the camp influence you to choose a STEM career?



Strongly agree: Did the camp inspire you to continue studies into a STEM degree?



Strongly agree: Would you recommend the camp?





STEM HIGH SCHOOL ENGAGEMENT

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This work is copyright. Insights and data in this report are drawn from survey datasets between 2013 - 2018, including events, workshop, STEM camp and teacher PD surveys; and Science and Engineering Faculty first year student survey (2015 - 2018).

Authors:

Simone Long and Rachel Jones, Science and Engineering Faculty
Emma Lieschke, STEM for Schools program, QUT
Marketing and Communications division.

We acknowledge the Turrbul and Yuggera people of the lands on which QUT now stands, paying respect to their Elders, lores, customs and creation spirits. We recognise that these lands have always been places of learning and teaching.

We also recognise the important role all Aboriginal and Torres Strait Islander people play within the QUT community.