

MAKE INTEGRATE EXPLORE



Project Report, 2021



OUR VISION

WE ENCOURAGE ALL STUDENTS TO IMAGINE THEMSELVES FOLLOWING STEM CAREERS AND TO DISCOURAGE STEREOTYPES AND FIXED MINDSETS RELATED TO SCIENCE AND MATHEMATICS. THIS HELPS DEVELOP POSITIVE EARLY CAREER ASPIRATIONS IN STEM CAREERS.

TO INSPIRE THE NEXT GENERATION OF STEM LEADERS



MIE Lab is a program which highlights the need for real world connections and provides schools and the community with opportunities to partner with business, industry and USC to strengthen transitions to post-school tertiary study.

MIE School provides a pathway for students to learn how to 'make' using technologies e.g. Arduino, how to 'integrate' by connecting to WIFI and databases, and how to 'explore' by using these skills and other technologies to solve real world problems in their local communities. MIE School focusses on building community awareness of STEM careers by including stakeholders in the program development. All program design, includes consultation with stakeholders to ensure that the content is authentic and able to be tailored to address the specific needs of each community.

MIE Community is designed to provide inspiration to the broader community and targets prospective undergraduate students of any age.

MIE Events brings together all things STEM in a range of exciting and engaging events hosted across the Sunshine Coast and beyond. Events include various challenges and immersive experiences to get students (and adults) excited about STEM.

WHO WE ARE



OUR AIM IS TO GARNER INTEREST IN STEM SUBJECTS AT SCHOOL, ENCOURAGE FUTURE TRANSITION INTO TERTIARY STUDIES AND SUPPORT THE POSITIVE GROWTH OF STEM OCCUPATIONS IN AUSTRALIA.

The MIE Lab project aims to widen the participation of low SES students' in accredited undergraduate qualifications at USC. It is an evidence-based initiative which translates research into programs designed to successfully alter perceptions of STEM careers and university pathways. The project provides direct exposure to science, technology, engineering and mathematics (STEM) activities and experiences.



2017 → 2018 → 2019 → 2020 → 2021 → 2022



The program has been running for over four years (HEPPP funded in 2019 for a Year 6 program in the Gympie and Sunshine Coast regions, funded again in 2020 for Year 6 and 7 programs in the Fraser Coast, Gympie, Sunshine Coast and Caboolture regions and funded again in 2021 for year 4 - 12 programs, MIE community and MIE Events in the Fraser Coast, Gympie, Sunshine Coast, Caboolture, Moreton Bay regions including rural and regional QLD).

THE MIE LAB PROJECT IS BASED ON SIX PILLARS, WHICH ARE EMBEDDED INTO THE CONTENT AND STRUCTURE OF ITS PROGRAMS, TAILORED TO ADDRESS THE SPECIFIC NEEDS OF EACH LOW SES POPULATION:



1

Providing school-based programs in middle childhood and adolescence (Years 4-12)



Focusing on ability enhancement and interest enhancement

2



3

Challenging Stereotypes about STEM occupations



4

Relevance of STEM skills to real careers



5

Inclusion of stakeholders (teachers, parents/carers, community, business and industry)



6

Results of the project fed back into research

PRIMARY

SCHOOL-BASED SESSIONS



“ IT WAS REALLY FUN BECAUSE OF THE ENDLESS POSSIBILITIES OF CODING WE CAN DO, IT HELPS US PERSEVERE AS WELL



The MIE School **Primary** project provides students in Years 4, 5 and 6 with familiarity opportunities for direct exposure to STEM activities and experiences. The program highlights the need for real world connections and provides schools and the community with opportunities to partner with business, industry and USC to strengthen transitions to post-school tertiary study.

MIE SCHOOL PROGRAMS HAVE BEEN DEVELOPED TO CREATE AN IMMERSIVE LEARNING EXPERIENCE FOR ALL STUDENTS. THROUGHOUT THE SESSIONS, STUDENTS DEVELOP PROBLEM SOLVING AND CREATIVE THINKING SKILLS, WHICH MOTIVATES AND INSPIRES THEM TO THINK OF NEW TECHNOLOGIES AND INNOVATIVE IDEAS.



PRIMARY PROGRAMS

YEAR 4 - SERIOUS GAME DESIGN AND PROGRAMMING USING SCRATCH

Students design and program a serious game, to educate others about how living things depend on each other and the environment to survive.

YEAR 5 - MICRO DRONES FOR AN ENVIRONMENTAL APPLICATION

Students learn how to program a micro drone (using block based coding in the Tello edu app) for an environmental application in the community.

YEAR 6 - CONTROLLING LIGHT USING ARDUINO PROGRAMMING

Students investigate how electrical energy can control light (circuitry) as they work in pairs to code their flashing lights using Arduino, to a piece of music.



SECONDARY SCHOOL-BASED SESSIONS

The MIE School **Secondary** program focuses on inspiring and motivating students' in Years 7-10 to have positive capability beliefs and attitudes to higher education as a viable post-school option. It focuses on strengthening engagement between USC and stakeholders, raises awareness of STEM careers, tertiary pathways, the value of tertiary study and reinforces the value of studying STEM subjects at secondary school.



THE MIE SCHOOL SECONDARY PROGRAM FOCUSES ON THE DEVELOPMENT OF COMPUTATIONAL THINKING SKILLS, SCIENCE COMMUNICATION, AND SCIENCE INQUIRY SKILLS



SECONDARY PROGRAMS

YEAR 7 – SELF-DRIVING CARS WITH ARDUINO

Students explore the social, ethical and environmental considerations required in the creation of self-driving cars and design and program a self-driving car using an Arduino.

YEAR 8 – SUSTAINABLE NEIGHBOURHOODS

A new program which has direct links to the United Nations Sustainable Development Goal 11. Students will use a serious game being adapted for the program and use critical and creative thinking in relation to current and future management and planning of Australia's cities and regional urban centres.

YEAR 9 – MIE BRAIN

Students investigate how the brain's structure and function underpin mental wellbeing and brain health. They work in groups to design and develop their own artistic interpretation of a specific brain region.

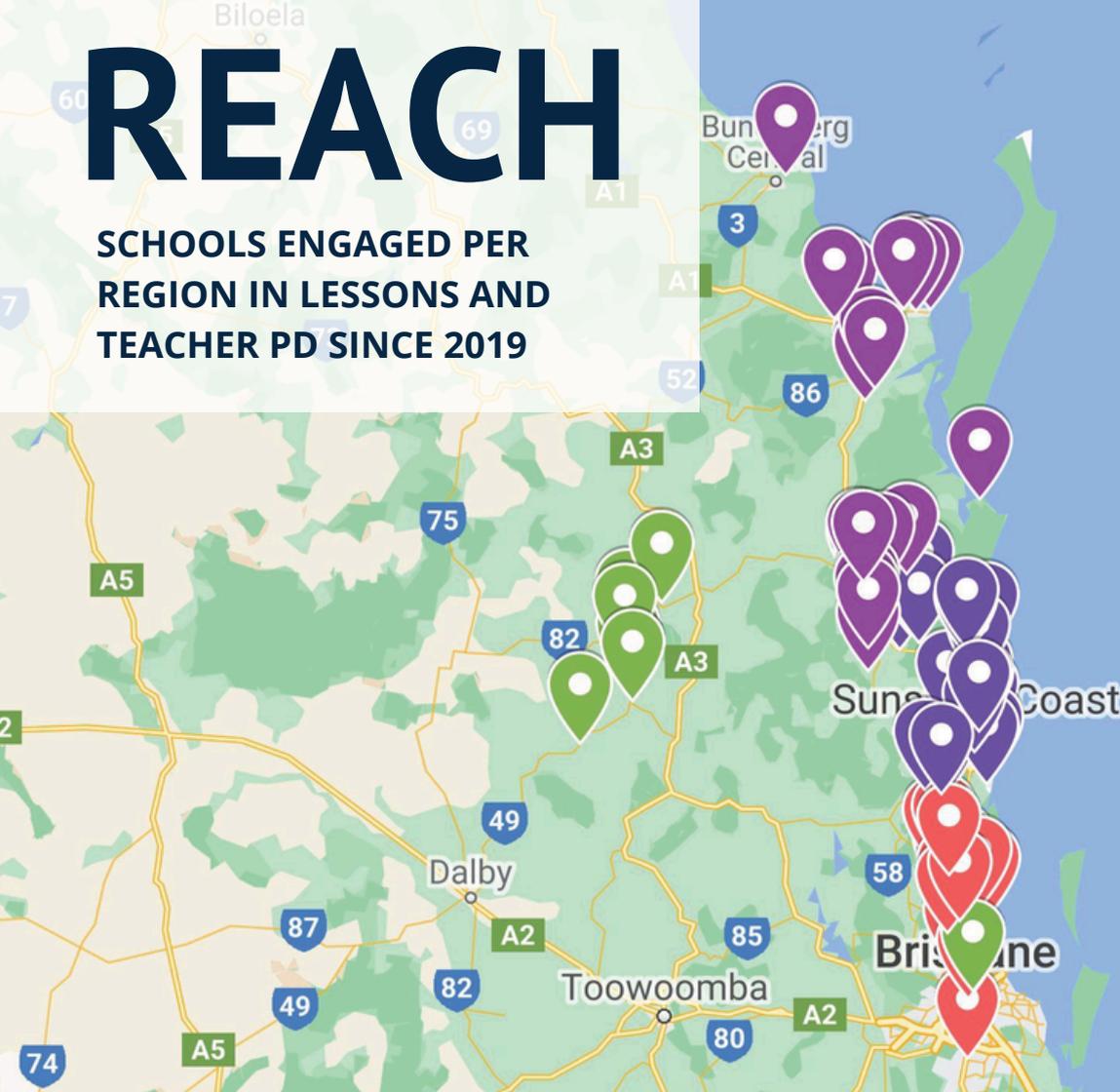
YEAR 10 – CITIZEN SCIENCE

A new program, which will focus on current USC research projects, with research students assisting in delivery of the program. Students will participate and collaborate in a citizen science project to capture research data and generate scientific knowledge on a current STEM project at USC.

“THE HIGHLIGHT OF THE ARDUINO LESSONS FOR ME WOULD PROBABLY BE WHEN WE LEARNT HOW TO CODE THE SENSORS TO BE ABLE TO SEE ITS SURROUNDINGS

REACH

SCHOOLS ENGAGED PER REGION IN LESSONS AND TEACHER PD SINCE 2019



2021

“THE HIGHLIGHT OF THE MIE TECHNOLOGY LESSONS, IN MY OPINION, WAS CODING THE LIGHTS TO THE MUSIC. THE WHOLE EXPERIENCE WAS ENJOYABLE, BUT I FOUND THAT CODING LIGHTS TO THE MUSIC WAS AMAZING BECAUSE YOU HAD THE FREEDOM TO MESS AROUND WITH IT AND CHOOSE WHICH PART OF THE SONG YOU DID. OVERALL, THE EXPERIENCE OF THE MIE SCHOOL TECHNOLOGY WAS GREAT, THE INSTRUCTORS WERE KIND, AND EVERYONE SUPPORTED ONE ANOTHER.”



49.49%
Female

48.36%
Male

2.15%
Prefer to self-describe

7.92%
Identify as ATSI

"SCHOOLS ARE SETTINGS WHICH CAN INSPIRE STUDENTS TO HAVE GOALS AND CREATE OPPORTUNITIES FOR THEMSELVES TO PURSUE THEIR PASSIONS"

NATALIE MCMASTER - PROJECT LEAD



87%

Found if they persevered they could solve challenges

71.5%

Were inspired to choose technologies subjects at school

Out of the students that were surveyed

90%

Thought the presenters were good role models

95.56%

Enjoyed the lessons

88.31%

Understanding of coding had improved

74.74%

Interest in coding increased



2156

Students participated in face-to-face lessons, in 2021



I LIKED WHEN MY PARTNER AND I SOLVED A PROBLEM TOGETHER AND GOT BETTER AT TEAMWORK



TRAINING FOR USC STUDENTS



I'VE ENCOURAGED OTHER PRESERVICE TEACHERS TO GET INVOLVED IN MIE SCHOOL FOR A CONTEMPORARY AND INNOVATIVE HANDS ON EXPERIENCE IN SCHOOLS



DEVELOP CONFIDENCE AND SKILLS IN TEACHING ABOUT STEM CAREER EDUCATION
DEVELOP CONFIDENCE AND SKILLS IN TEACHING THE DIGITAL TECHNOLOGIES CURRICULUM
DEVELOP STUDENTS' GROWTH MINDSETS TO STEM SUBJECTS
CONDUCT AN ICT AND TECHNOLOGIES SELF-AUDIT
COMPUTATIONAL THINKING SKILLS AND THE FUTURE OF WORK

PROFESSIONAL DEVELOPMENT FOR TEACHERS



Our school-based programs include professional development courses for preservice teachers and teachers designed to build their STEM skills, develop their understanding of the Australian Curriculum: Technologies, and provide them with information about STEM careers and university pathways. The project also includes online workshops for parents and the community, aimed to reduce the implicit bias and stereotypes surrounding STEM careers in the community.

Throughout the sessions, it is ensured that conversations about 21st century skills are informally discussed, to raise awareness of how the future of work is changing, the value of tertiary study, and the need for job builders and creators in the future.



USC STUDENTS AS PRESENTERS

A CORE COMPONENT IN THE MIE LAB PROJECT IS THE TRAINING, SUPPORT AND MENTORING OF USC PRESERVICE TEACHERS AND USC STUDENTS IN STEM FIELDS AS PRESENTERS FOR THE PROGRAMS.

USC students are provided with all the necessary training, teaching resources and equipment to conduct the program and lessons in schools. This is designed to increase USC students' confidence in science communication, teaching STEM in the classroom, managing behaviour and modifying lessons to cater for all students in the classroom, thus strengthening their graduate employability. USC students and preservice teachers have been presenting the MIE School Primary programs since 2017 to gain Wider Field Experience hours, Student Leadership Points and further paid employment in their field of study in their local region. In 2021, this training has expanded to include MIE School Secondary programs.

“HAVING THE CHANCE TO SHOWCASE OUR SKILLS AS A PRE-SERVICE TEACHER DELIVERING STEM LESSONS IS AN OPPORTUNITY WE WOULD NOT HAVE OTHERWISE



RURAL TOUR

IN JULY 2021, 3 USC STAFF AND 10 PRESERVICE TEACHERS PARTICIPATED IN THE MIE SCHOOL PRIMARY RURAL TOUR, A 5-DAY EXPERIENCE IN A RURAL LOCATION IN QUEENSLAND TO DELIVER THE YEAR 4, 5 AND 6 LESSONS IN REGIONAL SCHOOLS.

6 schools and over 250 students in the South Burnett Region were involved in the MIE School Primary Rural Tour excursion, which assisted both the career development and employment options for pre-service teachers and provided the opportunity for school students in rural locations with the same in-class experiences as those who are in urban areas. Pre-service teachers were able to undertake Wider Field Experience while being supported at university, hone their teaching and behaviour management skills in the classroom, and develop personal connections with peers across multiple USC campus locations. The school students received hands on, inquiry-based learning linked to real life experiences and delivered by USC role models. They had access to technology they would have otherwise not had access to, and the in-service teachers from those schools gained STEM teaching experience while they assisted with the delivery of the lessons.



“WE WERE PROVIDED WITH A UNIQUE EXPERIENCE TO APPLY PEDAGOGIES AND BEHAVIOUR MANAGEMENT TECHNIQUES THROUGH DELIVERING ENGAGING TECHNOLOGY CLASSES. THE SCRATCH PILOT PROGRAM CHALLENGED ME TO DELIVER A LESSON I WASN'T FAMILIAR WITH AND TO ADJUST STRATEGIES IMMEDIATELY TO TRY AND TEST ON THE NEXT CLASS. THIS IS ALWAYS A GREAT OPPORTUNITY TO REFLECT ON WHAT WORKED AND WHAT DIDN'T WORK. IT WAS A GREAT TRIP AND ASSISTED IN MY TEACHING CONFIDENCE IN A SAFE AND SUPPORTIVE PROGRAM.”



ROBOTICS CLUB

“VERY WELL RUN, AND AS A PARENT I WOULD LIKE TO EXPRESS MY GRATITUDE AND THANKS FOR SUCH A FUN, MOTIVATING AND ENTHUSIASTIC COURSE, THANK YOU VERY MUCH

A MIE Community Robotics Club was established for students in Years 5, 6 and 7 from schools with no or limited access to a robotics club or are home schooled. The Robotics Club ran every Saturday morning for 11 weeks in Semester 1 2021, at the USC Sunshine Coast Campus.

10 teams from the club competed at the 2021 RoboRave competition at USC stadium on Sunday 30th May, 2021 and an all-girls team took first place in the ES School Division, Lego Sumo Bot Challenge.

In term 2 of 2022, a robotics club for years 5, 6 and 7 will run for 10 weeks at USC Sunshine Coast, USC Moreton Bay and USC Fraser Coast. A years 10, 11 and 12 robotics club will also run for 10 weeks at the Moreton Bay campus. Each club will help develop participants robotics skills and prepare them for the RoboRave competition. The project is looking for community funding support so that the the club can extend for 12 months. The clubs aim to raise aspirations of students and consider thinking about a future career in robotics, engineering, mechatronics and are delivered by robotics experts in the regional community and supported by current USC students who provide mentoring and support for the students in the clubs.



COMMUNITY



Parents agreed after attending the MIE Robotics Club their children were more likely to consider going to University or TAFE in the future.



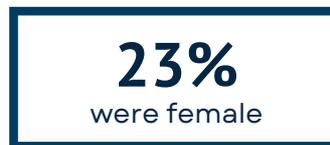
70%

SAID THE PRESENTERS HELPED THEM A LOT, OR A GREAT DEAL TO TRY DIFFERENT STRATEGIES, PROVIDE ENCOURAGEMENT, AND WERE GOOD ROLE MODELS

58%

WOULD RECOMMEND THE MIE COMMUNITY ROBOTICS CLUB TO OTHERS

24 STUDENTS FROM 7 SCHOOLS PARTICIPATED IN THE ROBOTICS CLUB, INCLUDING 1 HOME SCHOOLED STUDENT



The Robotics Club entered 10 teams at the National RoboRave event held at the USC Sunshine Coast Stadium. One team won their Sumo Bot competition with another team coming runner up in another event.

PARENT AND CARER FEEDBACK:

- 28% MALE, 72% FEMALE
- 94% WOULD RECOMMEND MIE ROBOTICS CLUB TO OTHERS
- 95% SAID THE PRESENTERS HELPED A LOT, OR A GREAT DEAL WITH THEIR CHILDREN: TO TRY DIFFERENT STRATEGIES, PROVIDE ENCOURAGEMENT, AND WERE ALSO GOOD ROLE MODELS FOR THEIR CHILDREN

ON CAMPUS EVENTS



OUR EVENTS AIM TO PROVIDE STUDENTS AND THE COMMUNITY WITH EXPOSURE TO STEM ACTIVITIES AND EXPERIENCES, AND ALSO AIM TO CHANGE PERCEPTIONS OF STEM CAREERS AND UNIVERSITY PATHWAYS

The programs consist of large on campus days and 'one off' multi-school challenges and competitions aimed to foster a love for collaboration and lifelong passion for STEM. These activities are designed to provide students with the opportunity to experience what life is like at university, interacting with Academic staff, university students and network with industry.

Throughout 2021 MIE Events successfully delivered a culmination of activities and events to further support the pursuit of STEM interests in students, teachers, families, and the wider community. The program offered a suite of STEM events and competitions which target prospective students in Years 7 to 12 and successfully introduced an additional 5 events throughout the year. The program was successful in building partnerships with schools and community while partnering with various industry members to deliver engaging and educational content. Throughout the year MIE Events established valuable connections with schools which lead to further development and planning of events in 2022.

“ I LEARNT THAT THERE ARE MORE AREAS OF STEM I DIDN'T KNOW ABOUT THAT INTEREST ME

EVENTS IN 2021

- SCIENCE & ENGINEERING CHALLENGE
- MATHS EXPLAINS OUR WORLD (MEOW) PROGRAM
- MATHS MODELLING CHALLENGE
- STEM CONNECT REGIONAL GIRLS DAY
- STEM CONNECT DAY ATHENA PROGRAM
- STEM CONNECT BIOLOGY DAY
- KIDS IN ACTION
- EDUCATION QLD STEM CONFERENCE PRESENTATION
- DREAM BIG - ENGINEERS AUSTRALIA
- NATIONAL SCIENCE WEEK ONLINE EVENT
- AUSSIE WORLD FUN PHYSICS DAY
- HOD STEM MEETING

THE SCIENCE AND ENGINEERING CHALLENGE



ATTENDED BY OVER 670 YEAR 10 STUDENTS, THE SCIENCE AND ENGINEERING CHALLENGE HELPED RAISE AWARENESS OF STEM CAREERS, TERTIARY PATHWAYS, THE VALUE OF TERTIARY STUDY, AND STUDYING STEM SUBJECTS AT SECONDARY SCHOOL THROUGH HANDS-ON, INQUIRY-BASED STEM ACTIVITIES

72%

said this event has increased their awareness of the relevance of STEM to any future job

73%

Strongly Agreed that after attending the Science and Engineering Challenge 2021 they are more likely to consider going to university or TAFE in the future.

80.3%

agreed that the event increased their awareness of STEM skills and their relation to careers

60%

OF PARTICIPANTS WERE NOW MORE LIKELY TO UNDERTAKE A STEM TERTIARY PATHWAY

71%

SAID THEY ARE NOW CONSIDERING STEM SUBJECT SELECTIONS AT SCHOOL

58%

SAID THEY ARE NOW MORE AWARE OF STEM CAREER OPPORTUNITIES

79.4%

SAID THEIR STEM INTEREST HAD INCREASED



MIE EVENTS KEY OUTCOMES

- USC STUDENT VOLUNTEER ENGAGEMENT
- MIE EVENTS EMPLOYMENT OPPORTUNITIES FOR USC STUDENTS
- MALE AND FEMALE ROLE MODELS PRESENTING AND FACILITATING WORKSHOPS
- HANDS ON ACTIVITIES
- STEM LEARNING IN A HIGHER EDUCATION SETTING
- ENCOURAGEMENT OF A GROWTH MINDSET TO STEM
- CONTENT AVAILABLE ON THE WEBSITE FOR ANY EDUCATORS TO USE FOR FREE
- HIGHLIGHTING STEM OCCUPATIONS AND TERTIARY EDUCATION PATHWAYS
- REAL LIFE ROLE MODELS IN STEM OCCUPATIONS AND INDUSTRY PARTNERSHIPS AND CONNECTIONS
- COLLABORATION WITH USC SCHOOLS AND INDUSTRY

ROLE MODELS IN STEM

FROM LOCAL COMMUNITIES



SARAH EISENMENGER, ZEST ROBOTICS
ROBOTICS ENTREPRENEUR



JOSHUA RIDDELL, EMESENT
MECHATRONICS ENGINEER



DAVID WOODROW, SUNSHINE COAST COUNCIL
DRONE SURVEYOR

THE ROLE MODELS IN STEM CAMPAIGN AIMS TO HIGHLIGHT REAL-LIFE STEM OCCUPATIONS AND ROLE MODELS FROM LOCAL INDUSTRY, TO CREATE REAL CONNECTIONS, BUST STEREOTYPES SURROUNDING STEM OCCUPATIONS, RAISE ASPIRATIONS, AND ENCOURAGE STEM PATHWAYS



GARETH FRANCIS, GYMPIE REGIONAL LIBRARIES
EMERGING TECHNOLOGIES OFFICER

VIDEO PRODUCTION

OUR LOCALLY, AUSTRALIAN MADE EDUCATIONAL VIDEOS FOCUS ON BUSTING STEREOTYPES IN STEM CAREERS AND SHOWCASE PEOPLE IN LOCAL INDUSTRY. THE VIDEOS COVER THE MAIN POINTS OF CURRENT RESEARCH ABOUT DEVELOPING A GROWTH MINDSET IN STUDENTS, AND AIM TO ENCOURAGE A POSITIVE GROWTH IN STEM CAREERS IN AUSTRALIA

The videos will be showcased in schools, online and in communities throughout 2022 and beyond to educate and inspire the community in:

- THE FUTURE OF WORK
- STEM SKILLS NEEDED
- CAPABILITIES – CRITICAL AND CREATIVE THINKING
- GROWTH MINDSET V FIXED MINDSET
- LANGUAGE USED TO DEVELOP GROWTH MINDSET
- BUSTING STEREOTYPES



FOR STUDENTS, TEACHERS, PARENTS AND THE COMMUNITY

RESEARCH



THE MIE LAB RESEARCH TEAM CONDUCTS RESEARCH INTO SEVERAL AREAS OF THE PROJECT TO IDENTIFY THE IMPACT THAT THE PROJECT, LESSONS AND RESOURCES HAVE ON INFLUENCING INCREASED INTEREST IN STEM BY STUDENTS IN YEARS 4 - 12. THIS RESEARCH IS USED TO EVALUATE THE PROJECT AND MAKE IMPROVEMENTS TO ITS PROGRAMS AND SHARE FINDINGS WITH OTHER RESEARCHERS AND PRACTITIONERS

A journal article on research findings from our Year 6 lessons in schools has been submitted - McMaster, N., Martin, D., Carey, M., Martin, J. (in press) Raising primary school boys and girls' awareness and interest in STEM-related activities, subjects and careers: An exploratory case-study, Australian Journal of Career Development.

The presentation at the 2021 STEM Teacher Symposium titled MIE Lab: Aspiring Year 6 students for a career in STEM. USC researchers Natalie McMaster, Dr David Martin and Dr Michael Carey presented information on the research which underpins the content and structure of the MIE School Year 6 lessons and shared information on the results of their research with Year 6 students.



Professor Maria Raciti is the lead author on a journal article on research findings from our Year 6 lessons in schools, which explores what influences Year 6 students from low SES backgrounds' job choices and how often parents/carers and teachers talk to them about jobs.



Professor Merrilyn Goos has joined the research team. Her academic research has investigated students' mathematical thinking, the impact of digital technologies on mathematics learning and teaching, numeracy across the curriculum and across the lifespan, the professional learning and development of mathematics teachers and mathematics teacher educators, curriculum and assessment reform in schools and higher education, and gender equity in STEM education.

2022 will see the start of the MIE Lab longitudinal research in QLD schools. The aim of the research is to explore to what extent early inquiry-based, hands-on experiences with STEM have on expectancies for success, task values, and STEM education and career aspirations among school students in the long-term, especially for girls.



MIE Lab is a widening participation program developed by USC to increase participation in tertiary education. It is partly funded by the Australian Government Department of Education and Training under the Higher Education Participation and Partnerships Program.