in Schools

Re-Engineering Australia Foundation Ltd

Re-Engineering Australia Foundation

STEM Educational Outcomes Report 2019

Engaging, Inspiring and Educating, Students Teachers and Industry.

Proudly Supported by the

Australian Government
Department of Defence

Visual Connections

Who We Are

Re-Engineering Australia Foundation Ltd (REA) is a not for profit social enterprise created to facilitates career intervention activities which link schools, industry, TAFE, universities and parents in a collaborative and entrepreneurial environment. Our focus is on encouraging students to engage with Science, Technology, Engineering and Maths (STEM). We are creating the next generation of innovators who will cement Australia's economic future.

AUTHORISED AGENT

Re-Engineering Australia Foundation Ltd.
PO Box 136
Castle Hill NSW 1765
P: 61 2 9620 9944
F: 61 2 8079 0622
E: contact@rea.org.au
W: www.rea.org.au

COPYRIGHT NOTICE

REPRODUCTION

REA Programs are 100% STEM

STEM is not what you learn - Its what you do with what you learn.

Contents

About REA

Re-Engineering Australia Foundation Ltd (REA) facilitates career intervention activities which link schools, industry, TAFE, universities and parents in a collaborative and entrepreneurial environment focused on encouraging students to engage with Science, Technology, Engineering and Maths (STEM).

At a time of rapid technological advancement, REA provides teachers with additional approaches to help the delivery of STEM-based education and technology in the classroom. Technologies which facilitate the development of the employability skills industry seeks.

Re-Engineering Australia Foundation (REA) was established in 1998 as a not-for-profit social enterprise with the primary objectives of increasing students' understanding of Science, Technology, Engineering and Maths (STEM) careers. We are now a leader in the design and implementation of STEM career intervention activities, recognised around the world, and the results show.

Over the past decade, our programs have directly mentored hundreds of thousands of students across Australia, from Thursday Island to Tasmania and from Sydney to Perth. Thousands of students are directly mentored in Australia each year with hundreds of thousands more benefiting from having access to the technology and knowledge we implement in school.

Our programs link schools, industry, TAFE, Universities and parents in a collaborative and entrepreneurial environment focused on attracting students to take up STEM-based subjects at school and careers after leaving school.

A significant reason behind the success of our programs is the practical and applied learning techniques we employ. We confront students with exciting challenges. We equip them with world-class tools and connect them to industry mentors to facilitate the development of their thirst for knowledge.

We empower students and inspire them to learn, creating a paradigm shift in the way we educate our children.

REA's goals are:

- Primary school students: promote awareness of science and begin presenting a coherent and holistic view of what STEM studies involve and how much fun they can be;
- Secondary school students: provide attractive action-learning programs aimed at developing students' understanding of real-world STEM, introducing technologies such as computer-aided design (CAD), computer-aided manufacturing (CAM), compute-aided engineering (CAE), computational fluid dynamics (CFD) and hands-on construction, in a competitive based environment;
- Tertiary students: increase enrollments in STEM-based courses, particularly those involving design, engineering and manufacturing studies;
- Industry: facilitate collaboration between students with industry via mentoring roles to further clarify real-world applications of STEM, engineering and manufacturing.

Our Mission

To engage, inspire and educate students, teachers and the community about the value of careers based in Science Technology, Engineering and Mathematics (STEM).

Our Vision

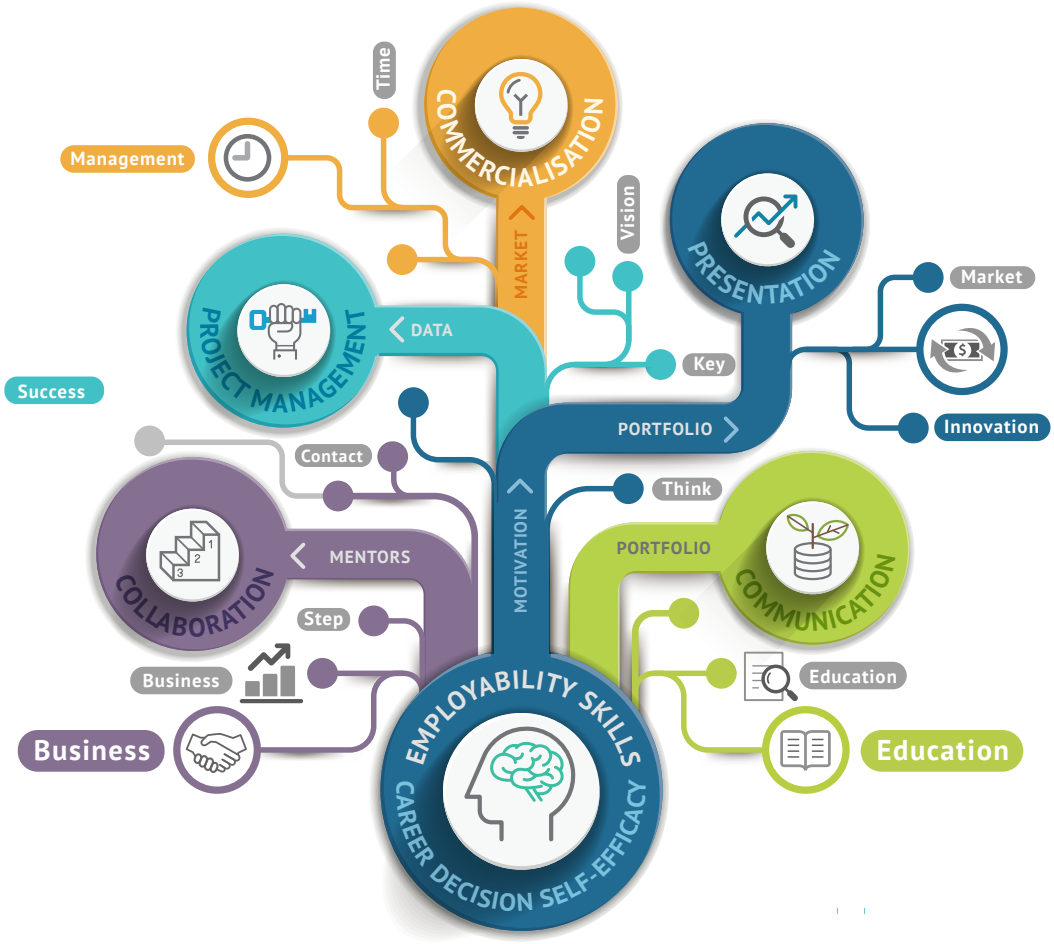
To create the entrepreneurs of the future who will re-engineer our Nation's ability to design and create our economic future.

Our Values

To provide knowledge, guidance and support to students and teachers which will set them on a path to succeed beyond their own expectations.

Our Strategy

“Our strategy is to build in students the enterprise and employability skills they need to make the transition to the world or work. As a Not for Profit Social Enterprise with both charity and Deductible Gift Recipient (DGR) status, we cement our long term sustainability through partnerships with industry and Government.



The World Economic Forum

“Technological trends such as the Fourth Industrial Revolution will create many new cross-functional roles for which employees will need both technical and social and analytical skills. Most existing education systems at all levels provide highly siloed training, and continue many 20th-century educational practices that are hindering progress on today’s talent and labour market issues”.

Our Programs

F1 in Schools STEM Challenge

F1 in Schools™ is a multi-faceted and multi-disciplinary program based on the design of miniature F1® race cars. It facilitates students collaborating with industry partners within the context of their projects to learn STEM principles. Program focus is toward students between 11 and 18 years of age.

SUBS in Schools Technology Challenge

SUBS in Schools is designed to equip students with the employability skills and knowledge to allow them to take part in the new set of industries created as a result of the Department of Defence Future Submarine Program. SUBS in School is aimed at students in years 5 to 12.

SPACE in Schools

SPACE in Schools is to expose students to the world of spacial design utilising 3D design and virtual reality software tools. Todays Engineering & Architectural design environments are focused on design for human habitation. SPACE in Schools gives students the opportunity to design a human environment on Mars. Challenge is aimed at students in years 3 - 12.

Jaguar Primary School Challenge

Jaguar Primary School Challenge engages primary students as young as five years old in building and racing a paper-based F1® car. The program is a subset of the High School F1 in Schools™ Challenge and is aimed at students in years K-7.

Land Rover 4x4 in Schools STEM Challenge

Land Rover 4x4 in Schools Technology Challenge is an international program aimed at students aged 11 - 18 years old. The program has students designing and building a radio-controlled four-wheel drive (4x4) vehicle. It progresses from simple control through to the design of fully autonomous vehicles.

Creating World Champions

"Australian culture intrinsically produces great problem solvers. Our programs build on this innate skill by placing high importance on engagement with industry. Our students learn through both success and failure, along the way developing high levels of resilience. Since 2003 we have produced 7 World Championship teams in the largest and most complex STEM programs in the World.

WORLD CHAMPIONS

2006 2011 2012 2013 2016 2017 2018

World Champions F1 in Schools: 2006, 2011, 2012, 2013, 2017 & 2018
World Champions Land Rover 4x4 in Schools: 2016

REA started 20 years ago focusing on 21st-century skills in students with the goal of building the capacity of the nation. We started with an Engineering focus because we were from industry and we knew that the education system wasn't delivering enough students with the appropriate skills to become Engineers.

REA began out of a passion for making a difference. We didn't realise until 2006 that along the way we were creating the best STEM students in the world. In 2006 we produced our first set of STEM World Champions. Since then the methodology we use has gone from strength to strength.

Seven world championships and numerous other podium positions at final world events are a testament to the students and the ability of our programs to capitalise on their inherent capabilities.

We get the meaning and intent of STEM from our industrial heritage, and it is this heritage that has helped us become recognised for producing the best STEM students in the world.

With 75% of the students, we engage with each year indicating that they have changed their career aspirations to be STEM-based as a direct result of participation in our programs our capacity to influence career decisions choice is unquestioned. The remaining 25% were most likely already committed to STEM.

STEM is not about "what you learn" ... it's not about "more maths", "more science", "more coding" or "more of the same". STEM is about "what you do with what you learn". ... it's about moving away with a siloed education system and aligning educational outcomes with the requirements of the industry. All of the activities of REA are directly alighted to the development of employability skills and the 21st Century skills as defined by the World Economic Forum.

Podium Places include

1st Place:	7 times
2nd Place:	6 times
3rd Place:	5 times
4th Place:	3 times
5th Place:	6 times

Students learn through both success and failure, along the way developing high levels of resilience. Australia intrinsically produces great problem solvers and can provide the quantity and quality of students that the industry will need into the future.

Within each of the programs, a great deal of focus is on helping students become successful entrepreneurs and to make this happen we get out of their way.

What is required by industry is to focus on improving the attractiveness of the sector. REA's programs place high importance on engagement with industry as a means of creating this understanding and attractiveness.

Researching Program Effectiveness

> Each year REA undertakes to measure the effectiveness of each of its programs against an internal set of research objectives which align with the goals of Industry.

REA is undertaking longitudinal research which will help in determining:

- The impact its programs are having on individuals,
- The incidence and influence the programs have on schools,
- The capacity to increase students understanding of the opportunities which exist in STEM-based careers
- To identifying student's motivation toward careers in STEM and STEM subjects at school.

REA uses the results to make changes to its programs. The research process is in the form of survey questionnaires which are competed by both teachers and students. The surveys collected both quantitative and qualitative data. The qualitative data focuses on examining the attitudes of both the teachers and students to various topics relating to their involvement in the programs. It allowed for a cross-referencing against the quantitative analysis.

The sample size for this research each year is 600 students and 90 teachers from NSW, Qld, WA, Vic, WA & Tas. The students and teachers involved in the survey were in the most part participants at a State and National Finals of the competitions REA runs.

Teacher surveys collected the following data:

- Demographics,
- The influence each of the programs had within their school on increasing the general interest in STEM,
- The impact each of the programs had in changing attitudes of students toward study across all subject disciplines,
- The impact each of the programs had on students,
- Impact of programs on Boys vs Girls,
- The influence of gender in influencing involvement of students,

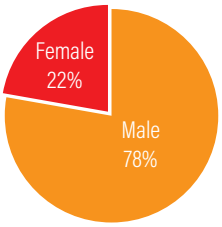
Student surveys collected the following data:

- Demographics,
- Students Motivation toward STEM,
- Influence of the programs on engagement with STEM activities,
- The impact of the program on subject selection at schools, mainly maths and science,
- Interaction of the students with Industries,
- The level of interaction the students had with Industry,
- Engagement with Industry Mentors
- Student interest in Careers in print, graphics and signage

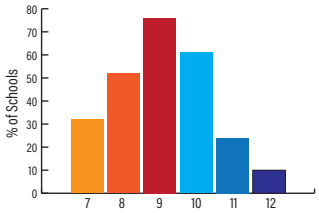
Teacher Demographics

The following are the demographics of the teacher cohort of the most recent survey audience.

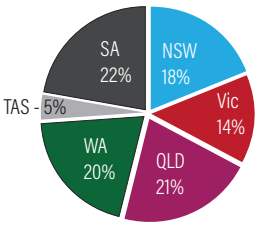
Teacher Participation by Gender



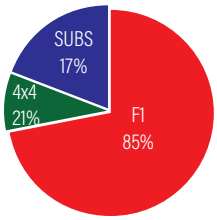
Schools Years Taught



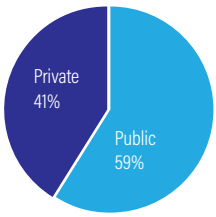
Teacher Participation by State



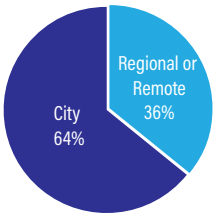
Schools Engagement in REA Programs



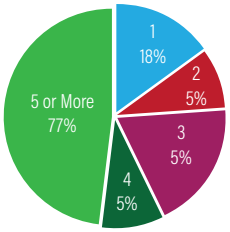
Teacher Participation by School Classification



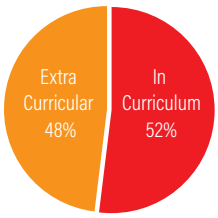
Teacher Participation by Region



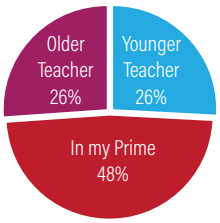
If Previously Involved, the Number of Years Involved



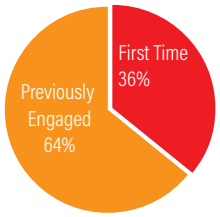
Delivery of REA Programs: In Curriculum or Extra-Curricular?



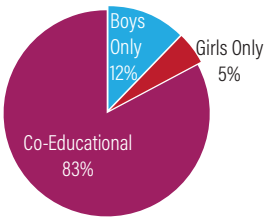
Teacher Experience



Teacher Engagement in REA programs



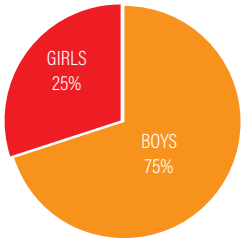
Schools by Gender Classification



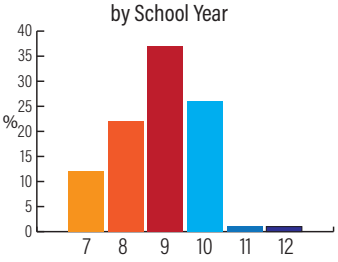
Student Demographics

The following are the demographics of the teacher cohort of the survey audience.

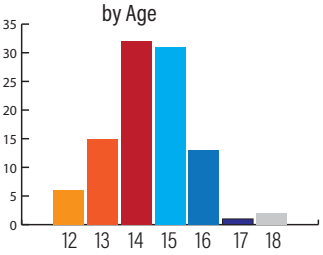
Survey Participants by Gender



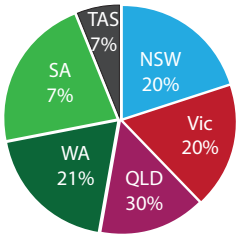
Sudent Participants by School Year



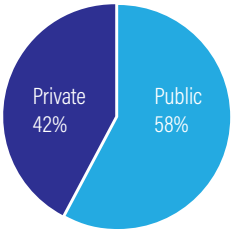
Student Participants by Age



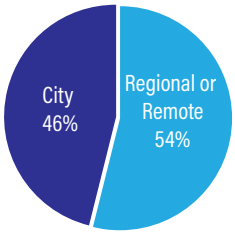
Participants by State



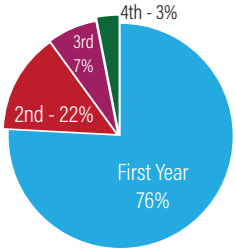
Survey Participants by School Type



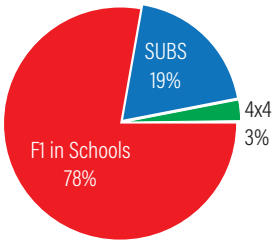
Survey Participants by School Location



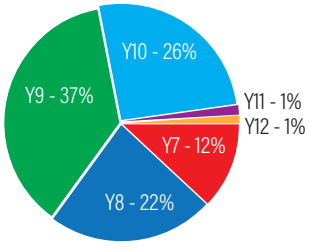
Number of Years Students have Participated in REA Programs



Respondents by Programs



Current Schools Year



Influence on Student Motivation

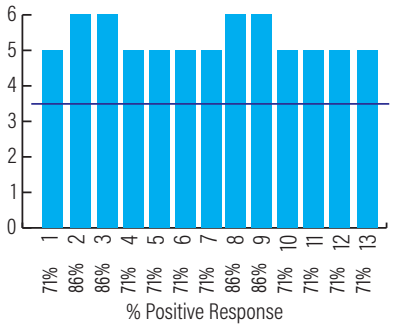
If students are intrinsically motivated to careers in STEM, attracting them to the exiting STEM opportunities which exist in industry will be much easier.

The research via a set of validated-scale of questions asked students for their perspective on the overall influence of the program and more specifically the impact of the mentors and role models they had engaged during the program, had on their STEM career motivations. The Plot of Averages of the student responses highlights an extremely positive response to the impact of the program and their interaction with industry role models. Scores above 3.5 are considered positive, and in this case, the plot of all averages was well above 3.5.

The key findings from these survey were the following:

- 76% Met people during the project that inspired them.
- 89% Have a much clearer understanding of STEM as a career.
- 83% Are more interested in careers in STEM.
- 73% Role models changed their perception of STEM careers.
- 50% Companies helped change their perceptions of STEM.
- 90% Like using technology used by industry in the project.
- 92% Through the project was "cool".
- 71% Met people that inspired them to take up a career in STEM.
- 62% Believe they learned a great deal about Defence industries.

Influence of REA Programs and Peer groups on Student Motivation to Choose STEM careers (Plot of Averages)



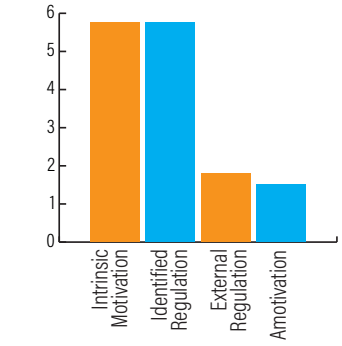
The research also asked students via a set of validated scale questions (SIMS Scale) to determine their intrinsic motivation toward their involvement in STEM, and the program they were engaged with i.e. do they choose to be involved of their own desire or were they forced to be involved.

Again in these results show a very positive attitude toward their involvement in STEM activities and their willingness to choose a STEM career.

The key findings were the following:

- 94% Believe that STEM is interesting.
- 80% Chose to participate for their own good.
- 84% Believe that STEM is good for them.
- 83% Think STEM is Fun.
- 88% Clearly understand what STEM brings to them.
- 86% Feel good when they were doing the project.
- 89% Believe being involved in STEM is important to them.

Situational Intrinsic Motivation of Students to STEM Career (SIMS Scale)



Improving Educational Performance

"To meet the challenges of ever more sophisticated international competition in advanced products and services, employers need to be able to access an increasingly skilled workforce, whose skills include traditional sciences and mathematics, communications technologies (ICT), and the 21st century skills that prepare our youth for a lifetime of unfolding career opportunities".

... Dr Alan Finkel AO Chief Scientist Australia (2017).

Teacher Perception of Increased Performance Across Subject Areas

STEM education is not about "what you learn" ... it's not about "more maths", "more science", "more coding" or "more whatever". STEM is about "what you do with what you learn". ... it's about moving away with a siloed education system and aligning educational outcomes with the requirements of the industry.

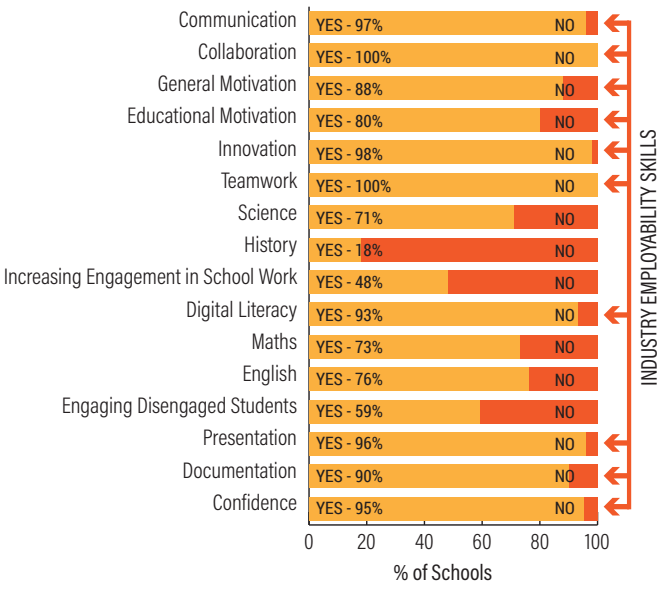
The teacher survey results highlight the capacity of STEM to impact the complete education process. Teacher perception is that as a consequence of their participation in REA programs students show a marked improvement in interest and performance across the majority of subject areas.

The survey results have shown a marked increase in the total educational outcomes for the students who participate. They highlight a capacity for the programs to bridge the educational silos which currently exist to deliver improved performance in all subjects.

Students are showing an increased ability to understand the importance of the subjects they are studying at school and how they relate to large-scale problem-solving and real careers.

The only subject that did not attract a significant improvement was History where only 18% of teachers recorded an increase in students performance.

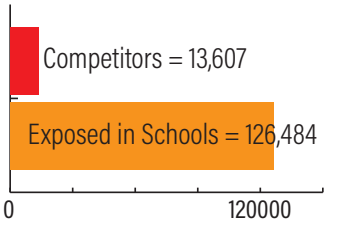
In Which Subject Areas Have You Seen a Visible Improvement in Student Performance as a Result of Their Participation in REA Programs:



Students Engagement

The number of high school students directly involved in the competition component of REA programs together with the number of students exposed to the outcomes of REA programs within the schools (as reported by teachers) is highlighted in the chart to the right.

Number of High Schools Student Competitors & Students Exposed to REA Programs in Competing Schools?



Influence on the Adoption of STEM

Bringing about career change is difficult in itself and requires a concerted effort over an extended trajectory. The marketplace littered with activities parading as solutions to STEM education which are unable to deliver long-term and lasting STEM educational outcomes. Only when you can confirm that you have made a change a student's long-term perception of career direction that you can claim success.

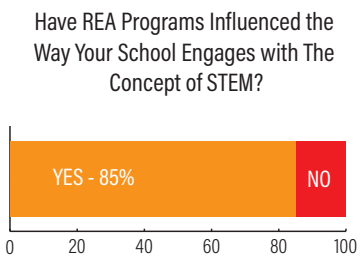
Unfortunately, poor STEM experiences lead to the development of poor enthusiasm for STEM in the students, in the teachers and the school and little measurable outcome. Poor experiences will not produce the pipeline of capable students that the industry is demanding.

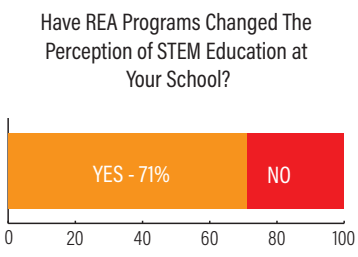
REA's programs are bringing about a measurable changing in not only students attitudes but also the attitudes toward STEM education with the whole school.

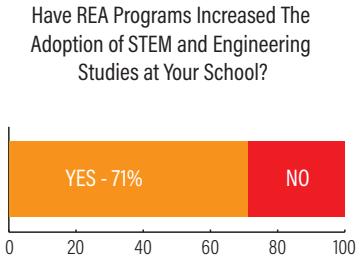
Within the research, teachers are asked to provide feedback on the impact REA's programs were having on increasing interest and involvement in STEM within their schools and the influence of gender on participation.

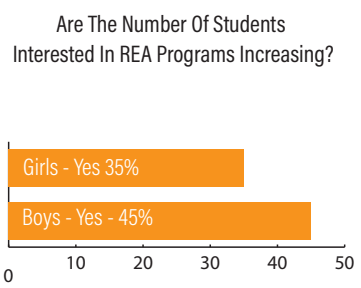
A key finding was that 75% of students indicated changed their motivation to follow a STEM career as a direct result of participating in REA programs.

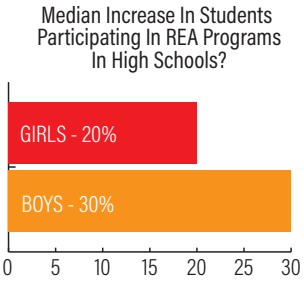
The following graphs highlight the teacher responses:

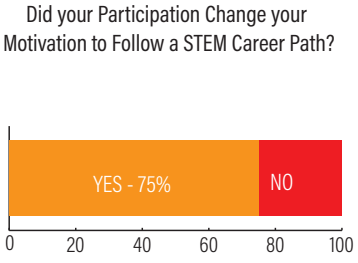


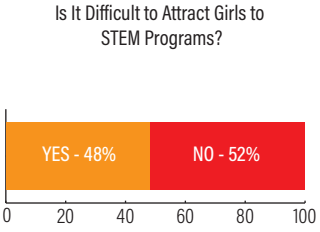


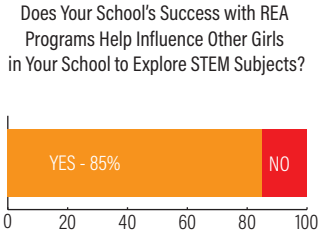












Influence on Adoption of Mathematics & Science

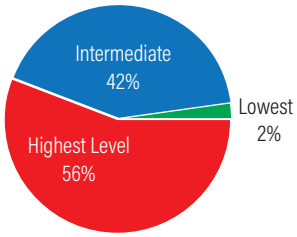
Science and Mathematics are essential educational foundations upon which STEM education can flourish. The research examined the impact of REA's programs on their adoption of maths and science subject at schools and the willingness of students to increase the level of maths and science that they would study.

Of note from the research, a majority of the students indicated that they were already studying Maths & Sciences at the remainder were now interested in exploring high levels as a result of their participation. A hypothesis under analysis via further REA research proposes that students with high levels of interest in maths and science subjects were attracted to STEM activities due to their capacity to allow students to apply their knowledge in practical ways the students can relate too. This data would appear to validate this hypothesis.

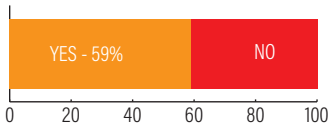
The following graphs highlight the student responses:

Student Attitudes Toward Mathematics

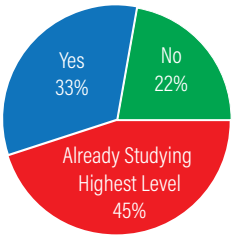
Level of Mathematics Studied at School



I am Now More Interested in Maths at School?

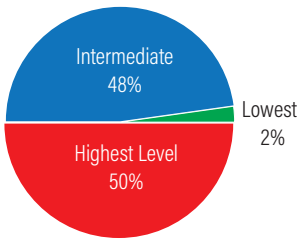


Are Students More Interest in Studying Higher Levels of Maths at School?

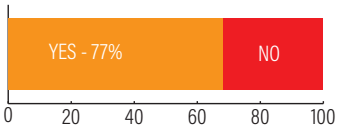


Student Attitudes Toward Science

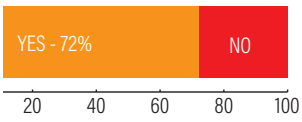
Level of Science Studied at School



I am Now More Interested in Studying Science at School?



ı Now Consider Studying a High Level of Science at School?



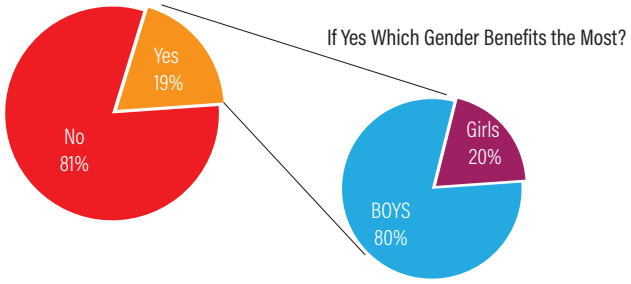
Influence of Gender on Participation

Students currently of both genders can require support to discover just how exciting and interesting the activities of Industry can be, particularly in areas of STEM. Learning environments which facilitate an increased understanding of the professions involved, in a way which fits with the different motivational drivers of Boys and Girls, goes a long way to promoting students' critical career decision processes.

Attracting girls into STEM careers has been problematic over the past 20 years. As part of our research, we examine the impact of gender on attraction to STEM in general, and to industries which classify as being STEM-based.

The research highlighted that the story about STEM needs to be told in a different way to Boys than it is to Girls. Boys need continuous human interaction particularly with role models and mentors to perform at their peak. Boys learn by apprenticeship and respond to the influence of role models. They need to touch jobs before making an emotional decision about career engagement. Movement of Boys into careers will increase when we can facilitate an increasing interaction between students and adults in industry roles. The underlying message is that during their career journey there will always be people around them who will help them to learn and grow. For Boys, careers should be described as a continual learning environment.

Does One Gender Benefit from Participation in REA Programs more that the other ?

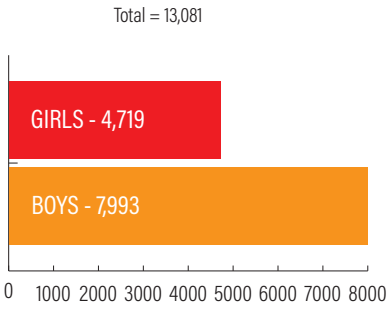


Girls, on the other hand, respond to managing complexity in environments. Highlighting the processes and complexity involved in career pathways will attract them to professions in those industries. Girls react positively to the project management aspects of careers and need to understand the processes involved in a career before they will choose that direction. Our research has highlighted that correctly targeted interventions can bring about a dramatic change in the number of Girls who have an interest in specific STEM career pathways.

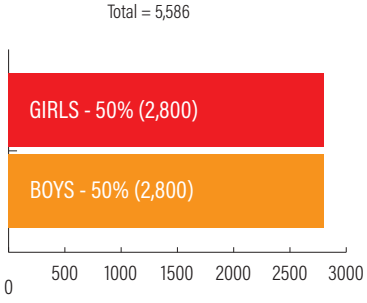
Key to REA's strategy is to engage with students without creating a level of separation based on issues of ethnicity, gender, diversity, age or religion. We treat all students the same and see no reasons to highlight blockages to career path selection. We are focused on using our understanding of the motivational drivers of children's career decision choices to attract the intrinsic interest of students no matter their gender or background.

While there still exists a perception that boys dominate STEM activities we are able to engage with girls just as successfully as we do boys. We do this by utilising the appropriate language which brings the programs within motivation that the students, boys and girls, can relate too.

Number of High Schools Student Competitors in Finals Events by Gender.



Number of Primary Schools Students Participants by Gender.



At 2017 F1 in Schools World Finals Golden Diversity, a team of 6 girls from Queechy High School in Launceston were placed 12th Outright.

Engaging Indigenous Students

Thursday Island Community

REA became involved with indigenous students in 2007 when it established an F1 in Schools Hub on Thursday Island. This initiative provided all facets of the community with the catalyst to create new partnerships and develop existing relationships with industry and other regional communities. The TI community developed a sense of pride in their students' achievements and their involvement in the REA program having witnessed change and improvement in student self-confidence, work ethic and the development of skills relevant to local industry and beyond.

Students In Badgingarra WA

Badgingarra Primary School is perched on a hill three hours north of Perth, looking out across fields of canola and wheat. The approach to the school is lined with sculptures of native animals and a model of the Solar System made in limestone, set amongst native plants. In the classroom, the students are fine-tuning model racing cars they've designed and manufactured on-line.

Students participate in competitions, awards programs and community projects including the NATA Young Scientist of the Year awards, the Earthwatch Teachlive Whale Sharks of Ningaloo project, Community Hydrogen Fuel Vehicle Challenge and the F1 in Schools program.

Tjuntjuntjara Remote Community School

We have been working with the WA Schools Pathways Program, to implement 4x4 in Schools in the Tjuntjuntjara Remote Community School in South Australia. The Principal has publicly confirmed directly that 4x4 in Schools was an fantastic success with the students and that he had never before seen the students more engaged with the activity.

SILVERBACK RACING STEM EDUCATION MENTORS

Expansion Plan

REA is seeking funding to roll out its Outback STEM initiative. The goal of this proposal is to expand its programs into remote and indigenous school across Australia. The specific objectives for our activities in remote and indigenous communities include the following:

- Removing geographic disparities in year 12 studies and tertiary qualification attainment across the country. Access to education and training opportunities is one of the fundamental building blocks for a prosperous community; however, it can be difficult for students in regional and remote communities to take advantage of the opportunities that are readily available in areas of high population,
- Address the perception that poor education standards and lack of access to quality education exist in remote & regional areas. The gap in educational attainment, literacy and numeracy between indigenous and nonindigenous children – young people living in remote Aboriginal communities are severely disadvantaged with minimal access to training, VET and employment opportunities,
- Making it possible for students to study the latest technologies close to home negating the need to travel to the city to follow high tech careers,
- Building the foundations for economic development opportunities, particularly in centres in rapidly growing regions in poorer areas with high unemployment,
- Preventing migration of young adults from rural to metropolitan areas.

REA would like to undertake to expand the F1inSchools, 4x4 in Schools and SUBS in Schools Programs into schools in the Mid-West, Pilbara, Gascoyne and Kimberly Regions of Western Australia. We would do this by establishing a number of Design & Technology hubs in these regions, which would facilitate students in these areas being able to participate in REA's STEM activities. The proposal is the following:

1. Establish Design and Technology hubs in high schools in the Pilbara region. The locations of these Design and Technology Hubs in the Pilbara will be in the major centres of Port Headland, Karratha, Newman and Tom Price subject to final approval by the Principals.
2. Establish a Design and Technology hubs in high schools in Geraldton.
3. Establish a Design and Technology hubs in high schools in the Kimberly region of WA, initially in Broome.
4. Establish a Design and Technology hubs in a high school in the Gascoyne region in WA in Carnarvon and Exmouth and possibly through the School of Isolated and Distance Education.
5. Establish a Design and Technology hubs in a high school in the NT including Darwin, Alice Springs, Katherine & Tennant Creek.

To be successful, the budget for this expansion would need to include the implementation of industry standard-technology into the schools as a component of the project. It has been our experience that indigenous and remote students take to programs such as F1 in Schools with even more enthusiasm that do students in city schools. By expanding into regional and remote areas will allow many more lives to be directly impacted by STEM.

Industry Engagement

A fundamental and critical differentiator of the REA programs has been the requirement for students to work directly with industry partners in the context of their projects. Students have the opportunity to see a direct relevance between classroom activity they enjoy and the world of work.

In addition to the more apparent outcomes, students develop many personal and employability skills, learning about working in a team, working towards a common goal, time and resources management, seeking out industry support and mentors.

All REA programs require students to collaborate and interact with industry and industry mentors to learn about technology and career path options. To increase student engagement with Industry career pathways, rather than handing career information to students, REA has adopted a pull-strategy to focus students on possible career pathways. Each of our programs has students seeking out information about career pathways in Industry which aligns with their skills and motivations.

The assessment regime involved in each of the programs has students dedicating a portion of both their project presentations and project portfolio to highlighting the career research they have undertaken. This assessment forms part of the overall marking criteria for each competition.

Teacher awareness of Careers

Critical to increasing exposure of students to employment pathways in the industry is the need to raise the awareness and understanding of teachers to these career pathways. As part of the survey, we sought to determine the understanding teachers have of Industry and Industry career pathways and if the research the students were undertaking was having an impact on teacher knowledge.

Primary data collected from the teachers is included in Appendix A.

Partnerships

"Our industry partners and volunteers are a pivotal component of our success. Financial support from our corporate and philanthropic partners, brings us a step closer to our mission everyday.

The following are a small portion of the organisations who have assisted on our journey thus far.

Australian Government
Department of Defence

Visual Connections

DENFORD

JAMES N. KIRBY FOUNDATION

Roberts Family Foundation

Telstra

TOYOTA

State Government Victoria

Government of Western Australia Department of Commerce Industry, Science and Innovation

McLaren

AUTODESK

SAAB

BELL BAY ALUMINIUM
PACIFIC ALUMINIUM

Australian Government
Department of Education

DASSAULT SYSTEMES

BOEING

THALES

DCNS

Government of South Australia

Australian Institute of Project Management

ansto

IBM

JETTA

royal adelaide SHOW

Cummins

Cochlear™

ENGINEERS AUSTRALIA

Regional Development Australia

cams

ResMed

AMTIL
AUSTRALIAN MANUFACTURING TECHNOLOGY INSTITUTE LIMITED

CONSULT AUSTRALIA

eim
ENGINEERING IN MOTION.
INNOVATIVE EDUCATIONAL PROJECTS

DEFENCESA

DEAKIN UNIVERSITY AUSTRALIA

ACS Foundation

LAND ROVER

babcock
trusted to deliver

ASC

PAEA

BAE SYSTEMS

UNIVERSITY OF TECHNOLOGY SYDNEY

WESTERN SYDNEY UNIVERSITY

UNSW@ADFA
CANBERRA • AUSTRALIA

University of South Australia

CQUniversity AUSTRALIA

NORDON CYLINDERS

QMISOLUTIONS

Students Interest in Careers Defence Industries

Defence industries, the workforce behind the defence force, form a significant component of Australia's manufacturing sector. With the Federal Government investing $200Bn into defence over the next 20 years, a large portion of the new technology careers created will be in some way linked to defence industries. Developing a clear understanding of students and teacher attitudes toward careers defence industries will help government and industry understand how to attract students to these next generation career pathways.

Within REA's longitudinal research of both teacher and student, feedback is collected to determine an understanding of the definition of "Defence industries", careers in Defence and Defence Industries and interest in following Defence or Defence industry career pathways. The most recent research included 81 teachers and 600 students surveyed between August and December 2018. The key findings of student and teacher attitudes toward employment pathways into the Defence industry follow:

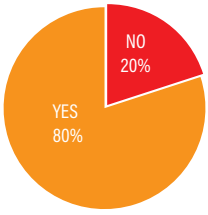
Teachers

Teacher oversee the career research undertaken by the students and are involved in industry engagement activities alongside the students. Teachers are thus key influencer's of student attitude and to increase students exposure to employment pathways into the defence industry. It is essential to ensure that teachers knowledge about employment pathways is high.

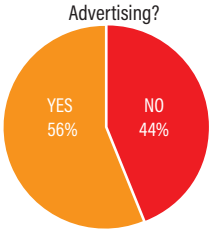
The research sought to measure teacher knowledge and understanding of defence industry career pathways and recognition of the role Defence industry plays in the development of Australia's economy

The following are their responses:

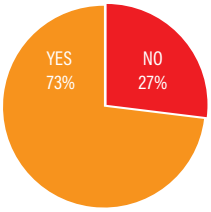
Do Teachers Understand the Definition "Defence Industries" ?



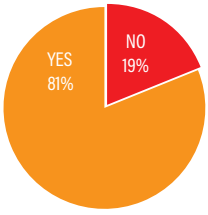
Do Teachers Recognise the "Workforce Behind the Defence Force" Advertising?



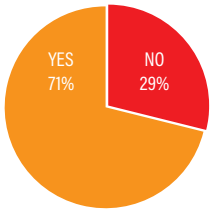
Do Teachers Understand The Role of Defence Industry in the Australian Economy?



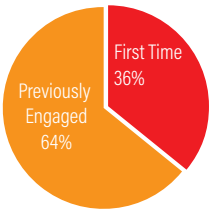
Do Teachers Understand The Career Opportunities Which Exist in Defence Industries?



Do Teachers Seek More Career Information About Careers In Defence Industries?



Teacher Engagement in REA programs



While there is a majority understanding within the teacher population of the role of defence industries, given the mentoring role that teachers play in influencing students career decision choices, there is significant room for improvement.

Careers

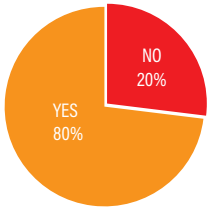
Proudly Supported by the
Australian Government
Department of Defence

Students

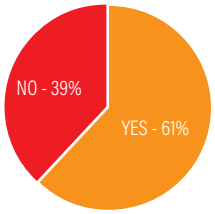
To determine the effectiveness of REA programs at influencing interest in Defence industry pathways, students were asked many questions related to their understanding of defence industries. While 50% of students surveyed would consider a career in Defence, 61% a career in defence industries and 71% of students would be willing to recommend to a peer to consider a career in defence industries. This willingness in a very large percentage of the demographic to make a personal recommendation to their peer group about careers in defence industries indicates that students have a very positive image of defence industries. Their desire to choose a career other than one in Defence industries would be due to other external influences rather than a lack of knowledge about Defence Industries.

The following are the student responses:

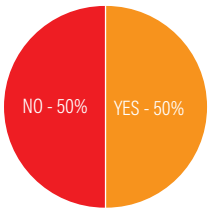
Do Students Understand the Definition "Defence Industries" ?



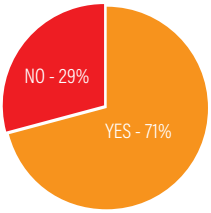
Would Students Consider a Career in Defence Related Industries?



Would Students Consider a Career in Defence?

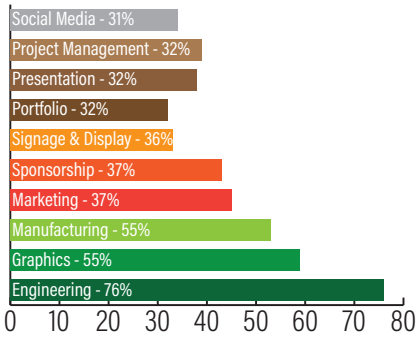


Would Students Recommend to Their Peers that they Consider a Career in Defence or Defence Industries?

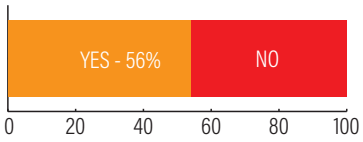


Students Interest in Careers in Print, Graphics & Signage

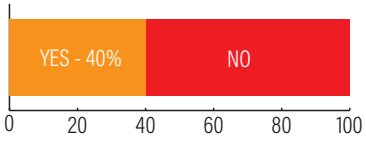
Which Areas of the Program did you Find the Most Interesting?



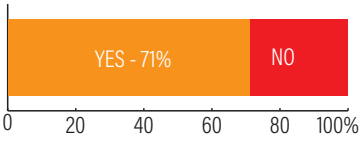
Would you consider a career in the Graphics, Print, Display or Signage Industries?



Are you interested in pursuing a Career in Graphics, Print, Display or Signage Industries?



Would Students Recommend to Their Peers to Consider a Career in Graphics, Print, Display or Signage Industries?



With the majority of projects requiring high levels of complex project development, students appear to be acknowledging the role industry plays in their plans and their career future.

Of note is the interest of 55% of students have an interest in the manufacturing element of the program. Given that the manufacturing industry is currently considered in decline in Australia, making up only 13% of our GDP, to have students with high levels of interest in manufacturing goes well for attracting students to the manufacturing careers.

If you combine students responses for Graphics, Signage & Display, 87% of students have an interest in these career areas. The task is now for industry to continue to engage with students to attract them toward the career pathways these industries offer.

When questioned about their interest in careers in Graphics, Print, Display & Signage industries, of the 600 interviewees in the latest survey, 56% of students would consider a career in the industry, 40% are interested in directly pursuing a career and 71% of students would recommend a career in Print, Signage & Display industries to there peers. Given that REA is currently interaction with 13,000 students who participate in its competition events the number of students interested in these career pathways is very high.

With 71% of students indicating that they would be willing recommend a career in these industries to their peers, it is a clear indication that students have no blockages to the sector or jobs in these industries. It is now up to the industry to assist students in making the final transition into the industry, through interaction with students and by the provision of ongoing positive messaging about the industry.

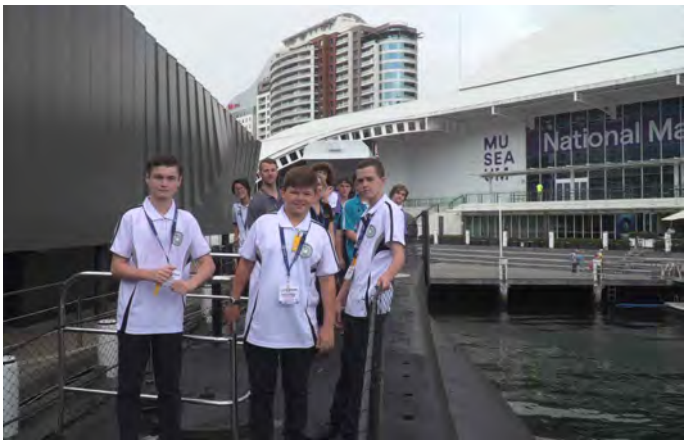
Of the students involved in the most recent survey, 770 interactions between students and companies in Sign, Graphics and Printing were notes, with students recording 532 site visits to companies in these industries.

Visual Connections

Exposure

During 2018 there have been significant opportunities to gain exposure of the activities we have been undertaking with students. The following images highlight a small proportion of the exposure that was achieved.

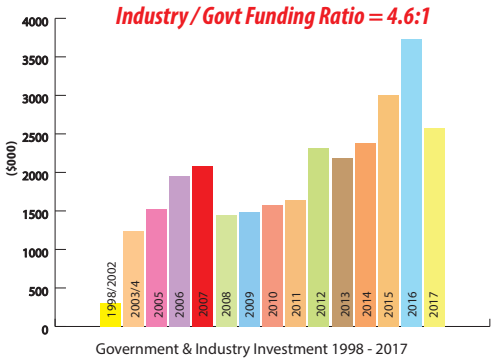
Exposure



Corporate Philanthropy

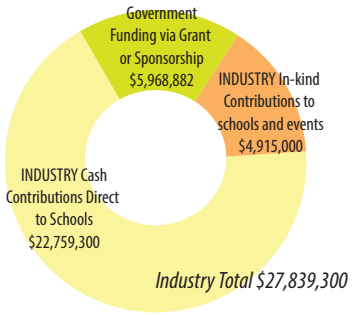
> Industry investment in REA programs has been significant between 1998 & 2019: in excess of $37Million. The majority of this has been directed to supplying technology into schools and assisting with the development of the skills of students and providing opportunities for the students to travel.

Industry & Goverment Financial Support of REA Programs 1998 - 2017 (Excluding Software Gifted to Schools)



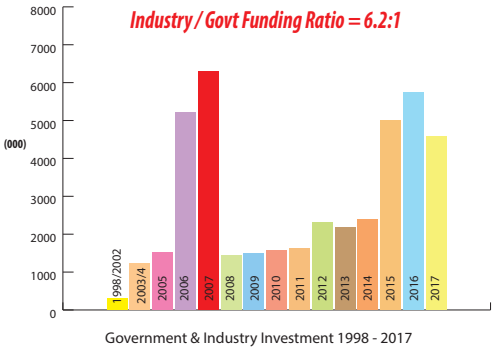
Government & Industry Investment 1998 - 2017

Industry & Goverment Financial Support of REA Programs 1998 - 2017 (Excluding Software Gifted to Schools)



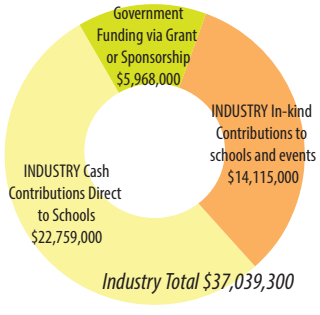
TOTAL $27,647,300 ***Industry / Govt Funding Ratio = 4.6:1***

Industry & Goverment Financial Support of REA Programs 1998 - 2017 (Including Software Gifted to Schools)



Government & Industry Investment 1998 - 2017

Industry & Goverment Financial Support of REA Programs 1998 - 2017 (Including Software Gifted to Schools)



TOTAL $42,843,182 ***Industry / Govt Funding Ratio = 6.2:1***

Future Programs

> As we seek to expand to our reach we have developed a number of programs which will broaden our scope and provide students with greater opportunities to build their employability skills.

Outback STEM Education Initiative

The Outback STEM Education Initiative expands F1 in Schools, Land Rover 4x4 in Schools, Jaguar Primary Challenges and SUBS in Schools into remote, regional and indigenous schools. It will provide opportunities to create links between schools in the city and indigenous students in regional and remote schools.

Silverback STEM Education Mentor

A program designed to encourage retired teachers and engineers to engage with students, helping them with their STEM projects. The program facilitates the knowledge which exists within older generations being shared with the new breed of teachers. Boys in particular are influenced by role models and this program supports the development of positive role models in society interacting with the students.

Architecture in Schools

Students from a city school adopt a remote or regional school and work with the students in that school to design a student/community space that reflects the needs of the local community. Students work with cartography, surveying, infrastructure planning and a broad range of STEM principles to develop a real world solution to an issue in a regional school community.

Solar Railways

Students adopt a country town and design a large scale elongated solar array utilising the existing rail infrastructure to power up the community. Students work with cartography, surveying, infrastructure planning and a broad range of STEM principles to develop a real world solution to an issue of regional community sustainability.

Entrepreneurs in Schools

Is a career relevance program directed at students who have already completed F1 in Schools™, SUBS in Schools or Land Rover 4x4 in Schools. It is through participating in these programs that the students have developed the majority of the entrepreneurial skills they are given the opportunity to start on the road to developing their own businesses.

REA : STEM on the Move

REA on the move is about taking STEM educational initiatives to regional and remote Australia. B-Double semi-trailers loaded with technology and STEM activities will travel to regional and remote communities to help eliminate the tyranny of distance around access to technology for students.

Appendix A - Teacher Feedback

Primary Research Data

What are the things you feel **you as a teacher** have learnt by participating in REA's Programs?

- Becoming a mentor or guide.
- Enthusiasm of students in the program
- In future I will be putting more of an emphasis on team collaboration and ensuring all team members read and understand the criteria.
- Better understanding of requirements for judging and rule compliance. Ideas to sport groups in marketing (ideas from students) and funding.
- Importance of using industry partners to ask questions etc.
- Ideas to further integrate into curriculum.
- Being first time in a REA competition have learnt a lot about the marketing and portfolio process. Will be better for the experience to help facilitate this process from the start next year.
- How to operate a CNC router.
- Accepting excellence is key.
- Increased awareness and opportunities to relate STEM to the curriculum.
- Networking, collaboration and helping other schools achieve in the program
- Talking with other schools
- To take a step back and allow students to direct their own learning. To facilitate students rather than focus on delivery of content and information.
- How good the experience is for students learning resilience and growing into the jobs REA programs represent.
- Creative learning
- Increased knowledge at Advanced Manufacturing Technologies
- How to use the CNC machine
- The importance of a solid foundation in all subjects is a necessity. The program needs to be supported by the maths and science departments. Mentors are an absolute must.
- I've seen clearly the positive impact F1 in schools has had on our students, particularly those who are disengaged. Parents have expressed their pride in seeing their children work harder than they ever have before.
- Its bits of work, but with the right solution the kids love it.
- Getting students to work in teams, skills involved in design work.
- Students have a much higher level of independent learning and productivity when they have a higher level of ownership and creativity in their tasks, the REA programs allow and extract this.
- Electronic skills, the resilience of students, students achieving goals, life long learning
- The links with other schools and the sharing of ideas
- I have learnt about the benefits for the students working on a cross curriculum project. Mostly relating to professional team work skills.
- That I need to build into curriculum
- Learnt how to extend my offering, to work in a technically demanding space, offer something that is engaging which means I need to know/ understand autodesk and car manufacturing elements to assist primary aged students.
- That opportunities to participate in nation/world wide events/competitions are high motivating, bring out the best in young people and provide an incredible opportunity for their personal growth.
- That it takes willing and dedicated teachers to make this happen in schools.
- That principals love the publicity.
- Requirements and expectation of REA comps.
- CAD/CAM processes, project management, communication
- It is always good to watch the students grow and develop in this program.
- F1 in schools is a great format for STEM.
- I have run PD for my professional organisation (DATTWA) to promote it.

- AutoCAD, photoshop, engineering, car design, CNC routers, how to use all these things.
- Giving students a project to work towards and guiding them but not giving them the answer.
- Long term challenging programs can be very rewarding both for students and teachers.
- Wide knowledge of possible career paths my students can potentially pursue.
- Teaching the 'soft' skills so students can participate more pro-actively in their career choices or realise new skills they can use.
- So many things! Programs, industries, better ways to link subject material, love it, will introduce it if I ever move schools.
- The value of project management skills such as organising a workflow to meet a deadline.
- A lot of learning happens outside of school
- Project management, communication, how to solder, 3D printing
- A more holistic view of what a stem based program can offer. Learning new skills and techniques that can be used with the students.
- Drastic learning curve in design technology, given that my background is a science teacher.
- Modern technologies, 3D printing, laser, industry connections, CAD, design, invent, test
- How to better coach my students through real world stem challenges.
- Communication, organisation, industry understanding
- Picking up practical skills in CADCAM. Including CNC, milling and 3D printing. Practical skills in finishing/assembly so I could pass skills onto students for their F1 entries.
- There is more to stem than just the curricular. Technical issues, planning and intrinsic motivation.
- People management, delivering complex content in phases to aid student understanding.
- Student engagement.
- Project management
- More industry contact, getting current trends.
- Further developed CAD skills in addition to CAM manufacturing
- The expectations around displays and competing in the competitions.
- Manufacturing techniques, industry collaborations.
- That it is a great opportunity for students and that's why Ill do it again next year and beyond.
- Always surprised by what students are capable of doing - solving problems, work arounds etc.
- Time management, people, software
- Problem solving, teamwork, collegiality
- People management. Delivering complex content in phases to aid student understanding.
- I have learnt more about supporting students to achieve based more on their own efforts.
- I have learnt that collaboration with business is important as are competition regulations.
- Using REA model to design, implement, evaluate new curriculum offerings i.e, 7r 7-10 inspire program.
- Our school still runs a 'line' structure 'STEM' as a standalone doesn't exist. There is a slow increase in tech amongst female students. The vast majority of our students choose science in senior school - mostly the medical industries or engineering.
- I have learnt how to package a diverse range of skills into a single program which allows for student creativity
- I've learnt that students need to do the work and we as teachers are just there for guidance.
- Strengthened skills in presentation techniques (verbal and written)
- I feel they are a great way to extend the student. They commit to a cause. Problem solve and work as a team. Very time consuming though.
- How far students can be pushed to achieve strong results. Students are capable of very complex ideas and concepts.
- Wider implementation of cross-curricular content

What are the learning **outcomes for the students** as a result of their participation in REA's Programs?

- Collaboration - with adults and fellow students, teamwork, Time management, competition - getting outside the fish bowl, quality management, pride, self worth
- Improved team work, time management, technical skills, working with other organisations.
- Lots of soft skills developed in participation in teams; skills in project management; skills in marketing.
- Learnt a lot about the engineering process and industry through working with SAAB. Great program to expose student critical thinking and problem solve skills along with time management.
- Improvement in digital literacy, cooperation.
- Students are learning life skills that they would otherwise not see until university.
- Use of CAD, project management, organisation, portfolio documentation
- Some are starting/have moved into engineering
- Engineering students, public speaking
- To develop life long learning skills which are reflective to real life. To develop inquiry and project based learning skills. To develop an interest in STEM subject areas.
- Teamwork, presentation and marketing skills verbal and printed, social media, multimedia, science, maths, engineering and technology STEM
- Time management, teamwork
- Effective team work, roles and responsibilities, rules and regulations
- Science - physics better understanding. Literacy - chance to improve. Business - real life authentic tasks.
- To apply physics concepts to improve designs, to develop team work and leadership skills, to use the design process to create solutions.
- Communication, creativity, problem solving, team work, resilience, independent learning, engineering
- Team work, resilience, communication, creativity, engineering, problem solving, life long relationships
- Jobs in industry, engineering skills
- Teamwork, electronics, movement and control
- Collaboration, public speaking, project management, lead to engineering and other STEM related careers.
- Circuits, ICT, art, logos, communication, organisation.
- Team work and time management
- Scientific principles related to aerodynamics, apply maths skills related to spatial awareness and measurements, learn how to manipulate materials and applications, create products to support their participation eg posters, 3D printed cars
- Collaboration, software use (design and presentations) communication skills.
- Technology and DT skills, teamwork, problem solving.
- Teamwork, project management, industry collaboration, presentation, communication, public speaking.
- Students learn teamwork, time management, finance, networking, technologies and more.
- Collab skills, time management, teamwork, verbal/language, computer/CCT skills, building website, marketing/branding, art/craft skills.
- Problem solving/the engineering process, communication, materials, design and technology.
- Collaboration and teamwork, negotiation, problem solving, resolving, critical thinking, critical literacy.
- New skills to tech that backs what they do. Appreciation of the links in projects. Outside industry knowledge. Working with the team and having to do it together.
- Ability to transfer knowledge from one contact to another.
- Team work, presentation skills, project management, responsibility
- A huge array of technical skills. Perhaps more importantly how to manage their time, project management, presentation skills and digital communication skills.

- Better participation in the areas of maths, science and technology based subjects. Students seem to become better at problem solving and think of solutions.
- Collaboration, communication, resilience, awareness of stem.
- Job prospects, career path
- Teamwork, engineering, budgeting, marketing, innovation, presentation skills.
- CAD CAM, modern technologies, design, test, evaluate
- Increased resilience, increased understanding of the relevance of stem, appreciation of the clue of hard work, determination and * rewards.
- Project work, communication skills, automated processes, visual communications, graphics, ICT skills, Voc Ed.
- They align with the competition regulations, technical drawings and portfolios.
- Organisation, interpersonal skills, technical skills
- Ability to: use Autodesk Inventor to create a F1 car, use flow design to test the aerodynamic ability of the car, design and modify, research, reflect and evaluate , think critically and creatively.
- Team work, design skills, life skills (when away competing), practical, resilience
- Team work, time management
- Time line, managing people, managing budgets, "do the math, save the world"
- CAD/CAM skills, enterprise, teamwork, collaboration
- Soft skills: critical thinking, negotiation, collaboration, meeting time lines and deadlines, problem solving, determination. word skills, working to specifications, use of CDD/CDM
- Teamwork, time management, collaboration, manufacturing skills.
- Better attendance, working and collaborating with others, being and thinking globally, working within our community.
- Broaden their horizons, opportunities, develop critical skills in stem subject areas, confidence to make effective judgements.
- Time management, team work, different programs
- Teamwork, collaboration, problem solving, critical thinking, creative thinking.
- Team work, time management
- Team management, design
- Teamwork, time management, broader view of career opportunity. The importance of maths and science.
- Working as a team, introduction to aerodynamics v drag v friction
- Organisation. Interpersonal skills. Technical skills.
- Collaboration skills, entrepreneurship, design for manufacture.
- Increased understanding / skills around STEM and more so the soft skills.
- We already have a long focus on engineering and medicine: our senior school programs in maths and science have very big classes. The students usually doing engineering (our middle years digital tech classes are big)
- Engagement with Industry mentors. Opportunities to learn new technology.
- More confident in communicating with adults and peers
- Time management. Using new programs (CAD, Illustrator etc.) Responding to criteria. Confidence.
- Leadership. Collaborative. Initiative. Problem Solving. Communication Skills. Design and Engineering Skills.
- Realising that they can achieve far more than.
- Relevance of what they are learning in school to future careers in STEM industries. Collaboration with industry.

Summary

> We provide opportunities for students and teachers to become the best in the world ... & we honor those who dare to be.

Our programs aim to develop skills in problem solving, research, communication, collaboration and teamwork. Skills that are clearly identified as aiding the transition through high school, skills in demand by industries the world over, skills not impacted by disruptive technologies.

Not for Profit, for the Future.

RE-ENGINEERING AUSTRALIA FOUNDATION

ENGAGE
INSPIRE
EDUCATE
STUDENTS
TEACHERS
INDUSTRY

Re-Engineering Australia Foundation Ltd
ABN: 12 095 876 323
Unit 7/20-22 Foundry Road
Seven Hills NSW 2147 Australia
PO Box 136, Castle Hill NSW 1765
Phone: +61 (02) 9620 9944 Int. Facsimile: +61 (02) 8079 0622 Email: contact@rea.org.au
Internet: www.rea.org.au