in Schools
Re-Engineering Australia Foundation Ltd

Re-Engineering Australia Foundation

STEM Educational Outcomes Report 2021

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

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Visual Connections

WHO WE ARE

Re-Engineering Australia Foundation Ltd (REA) is a not for profit social enterprise created to facilitate 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

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REA Programs are 100% STEM

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

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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 enrolments 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

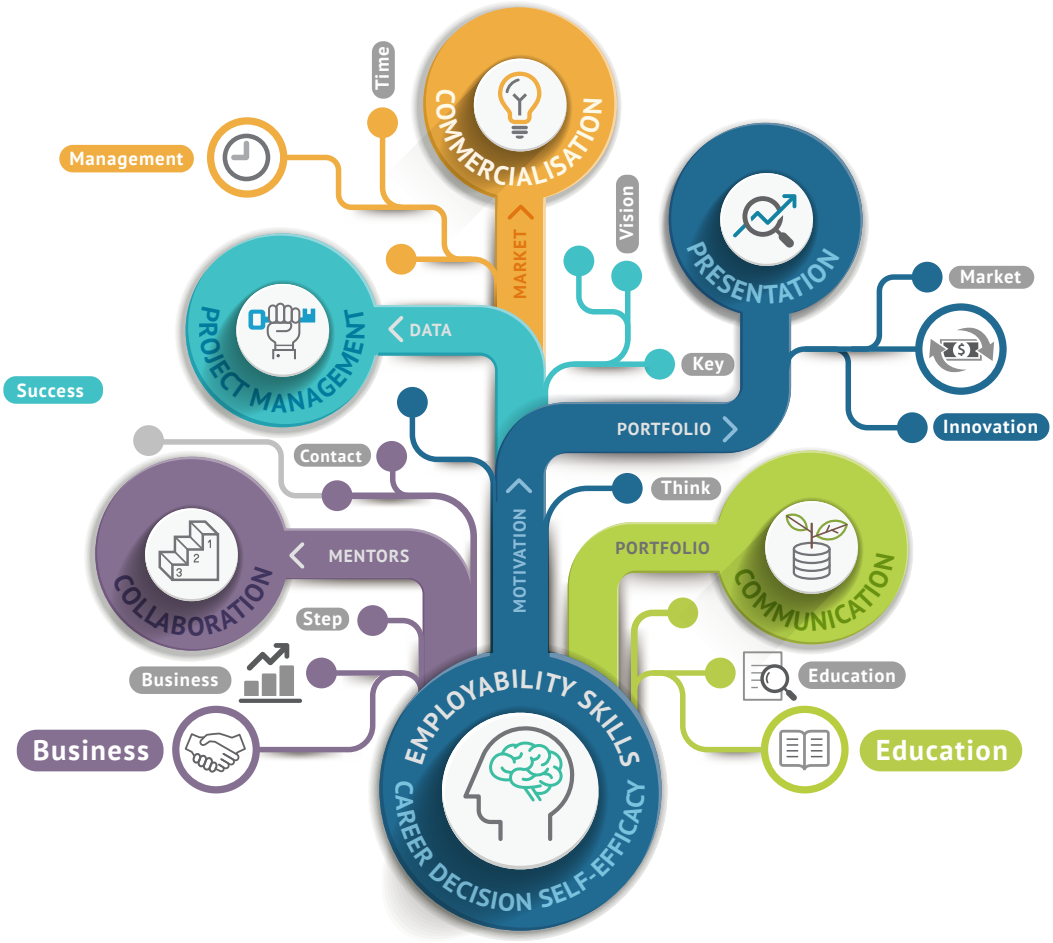
To create the entrepreneurs of the future who will re-engineer our Nation's ability to design and create our economic future.

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.



"Career decision self-efficacy in students builds with the development of employability skills. In line with industry recommendations for new entrant capabilities, each of REA's programs focuses on developing skills that are immediately transferable to industry roles"

OUR PROGRAMS

F1 in Schools Australia

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 Australia

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 Australia

SPACE in Schools is to expose students to the world of spacial design utilising 3D design and virtual reality software tools. Today's 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.

STEM in Primary
Re-Engineering Australia Foundation Ltd

Primary F1 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 to build fun and excitement around STEM activities for students in years K-7.

4x4 in Schools Australia

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

> **Australia intrinsically produces great problem solvers. The education system can deliver the quantity and quality of capable students Industry will need into the future. But to do this, students need exposure to the roles they can play in creating this future.**

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: 2013

REA started in 1998 with a passion to be a catalyst to expose students to how exciting careers in Engineering can be. We are from Industry and understood that the education system wasn't delivering students with the appropriate skills to facilitate their transition into Engineering and focusing on developing 21st-century skills would help build the nation's economic capacity.

It all began with a University-based competition before we realise we had to interface with children earlier in the education cycle. We move into high schools in 2003 and soon realised that we were creating the best STEM students in the world. We produced our first STEM World Champions in 2006. Since then, we have been the catalyst for seven World Championships and numerous category podium positions at international STEM competitions, a testament to our students' capabilities and our programs' ability to capitalise on their inherent problem-solving strengths.

We derive our image for STEM from our commercial heritage. 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 industry requirements. For us, it's about building employability skills on top of a foundation of communication and problem-solving. Foundation skills we all rely upon throughout our lives.

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

And our success? With 81% of the students indicating that they have changed their career aspirations to be STEM-based due to their participation, our capacity to influence career choice is unquestioned. Students learn through both success and failure, developing high levels of resilience and self-efficacy along the way.

Our programs place high importance on Industry engagement to build understanding and attractiveness of STEM careers. We are producing students with entrepreneurial capacity and project rapid start capabilities but to be successful, Industry needs to be committed to playing its part in this process.

"Once we start the learning journey, we get out of their way"

PROGRAM EFFECTIVENESS

All REA programs require long term engagement with STEM. Students who participated in the research competed at either a State or National Final level. This achievement level requires program engagement of between 6 months and four years.

The research we undertake looks to determine the program's impact on the students and teachers, the impact within the schools and any change in the students' educational attainment.

The primary research outcomes include:

- Determining the impact, the programs are having on individuals, students and teachers.
- Determining the influence the programs have in the schools.
- The capacity of the programs to increase students understanding of the opportunities which exist in STEM-based careers.
- Student's motivation toward careers in STEM and STEM subjects at school.
- Change in educational attainment as a result of participation.
- Impact of involvement on career pathway choice.

The research process is by way of questionnaires completed by teachers and students. The surveys collect both quantitative and qualitative data. The quantitative data focuses on examining the attitudes on various topics relating to their involvement, with the qualitative data used as a cross-referenced and validation against the quantitative data.

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.

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

BACKGROUND TO RESEARCH

Each year REA undertakes to survey students and teachers involved in its STEM programs. This research forms part of a longitudinal research process that started in 2008, examining the Motivational Drivers of Children's Career Decision Choices.

Each of REA's programs employs Action Learning principles (Experiential Learning), similarly to Scouting, Duke of Edinburgh Award Scheme Outward Bound and Army Cadets. Each implemented within an educational environment, with an overt focus on the students working with industry to resolve their problems.

Each student brings perceptions and incentives for participation in the program and may not be sterile in their STEM career motivation. A similar situation exists in the Outward Bound program (Martin and Leberman, 2005). Given these activities' experiential nature, the students' outcomes and benefits may not become evident to them until some time after they have completed their involvement.

In measuring student attitudes, it is crucial to understand what can be measured, how it is measured and whether these measurements can guide further development.

Between November and December 2020, REA had research questionnaires completed by 382 students and 57 teachers (49 Schools) from across Australia (all States and Territories except NT). Teachers and students received different questionnaires. Of these, 343 student responses and 49 of the teacher responses were valid, having all questions completed. Similarly, sized data sets have been collected each year since 2010.

In 2020 the number of students participating in REA programs was down slightly compared to previous years, primarily due to COVID-19. The total number of students who participated in the competition component during 2020 was more than 3,500, with 17,000 students exposed to the activities (as reported by teachers).

Survey participants were selected based on making it through to participate in the State or National Final events of either F1 in Schools, SUBS in Schools, 4x4 in Schools or Space in Schools. The challenge is to measure the change students see in themselves concerning their career choice, particularly about a career choice in STEM and whether the learning environment had a specific influence.

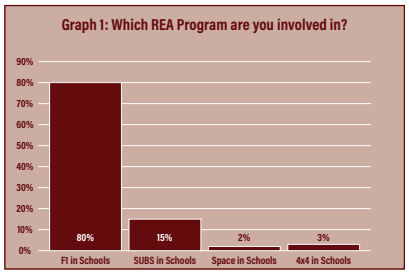
The following statement of the primary research question for the study which populates the data in this report:

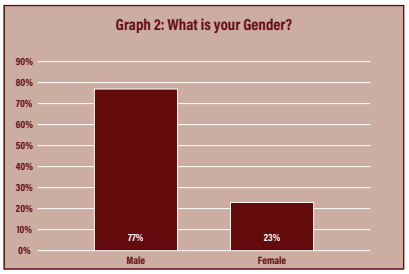
> **What influence do REA programs have on the participants' motivation towards STEM subjects at schools and STEM careers pathways?**

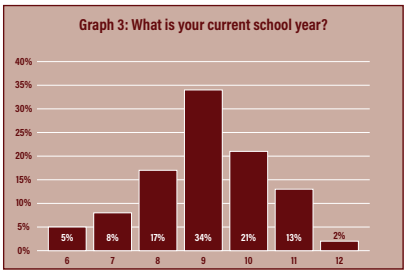
The challenge is to measure the change students see in themselves concerning their career choice, particularly about a career choice in STEM and whether the learning environment had a specific influence.

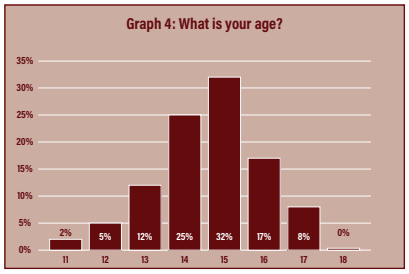
STUDENT DEMOGRAPHICS

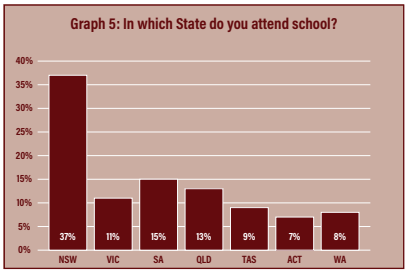
The following charts highlight the student demographic distribution of the students involved in the 2020 research.

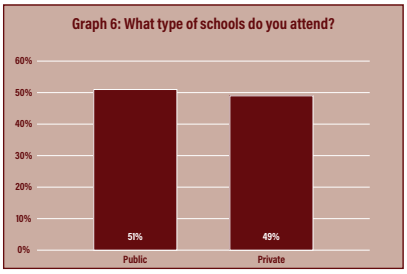


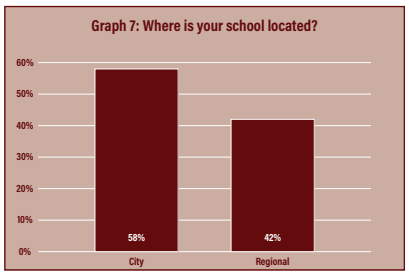


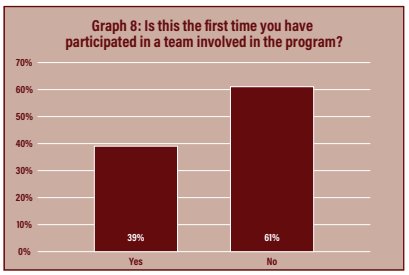












SITUATIONAL INTRINSIC MOTIVATION

When examining the effectiveness of programs in influencing students' career motivations, it is essential to understand their attitudes toward their activity. Are they undertaking the program because it is of their fruition, or are they operating under sufferance: something they must do or compelled to undertake. A student who displays high intrinsic motivation toward a task (participating for their reasons) is more likely to be committed, interested and do well in the activity. When that activity is career-related, they are also more likely to effectively choose their career direction from the data and experiences presented to them.

A portion of the questionnaire utilised the "Situational Intrinsic Motivation Scale" SIMS (Deci and Ryan, 1985, Guay et al., 2000). The SIMS scale is structured to assess the constructs of intrinsic motivation, identified regulation, external regulation, and amotivation (Deci and Ryan, 1985) based on the theories of self-determination. In this instance, the scale examines students' intrinsic situational motivation as a general factor influencing student interest toward STEM careers.

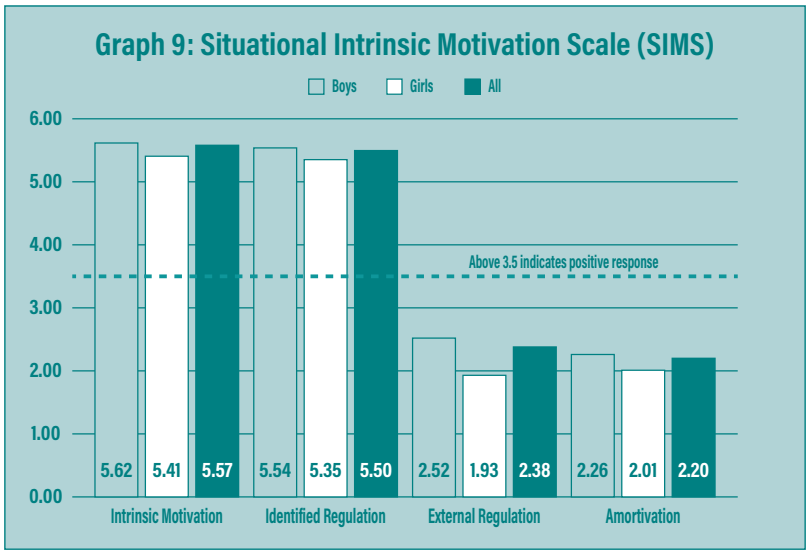
"I would be interested in a STEM career?"

Intrinsic motivation is associated with positive outcomes (e.g., persistence and resilience) followed by identified regulation. In contrast, the most negative (e.g., depressive states) will stem from amotivation followed by external Regulation (Deci and Ryan, 1985, Vallerand, 1997).

The SIMS scale contains four internal consistency factors which align with positions on the scale of self-determination.

- Intrinsic motivation: engaging activities for their own sake.
- Identified regulation: behaviour valued and perceived as being chosen by oneself.
- External regulation: conduct regulated by rewards or negative consequences.
- Amotivation: lack of perceived control.

The SIMS analysis results are in Graph 9, which summarises the average scores calculated for each of the four sub-scales for the group as a whole. These results indicate that students display high intrinsic motivation levels as scale totals above 3.5 are very positive, meaning that students are undertaking these programs of their desire and will. The general conclusion drawn from the data analysis is that the main reason for their interest is that they are intrinsically interested in STEM.



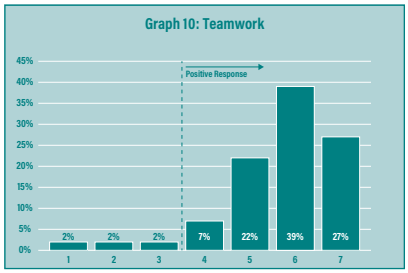
PROGRAM IMPACT

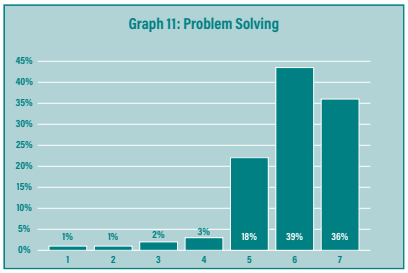
Survey questions sought to determine the program's impact and elements of the program that influenced career motivation. To be invited to participate in the questionnaire, students will have completed a program competition at a State of National Level. The primary question was:

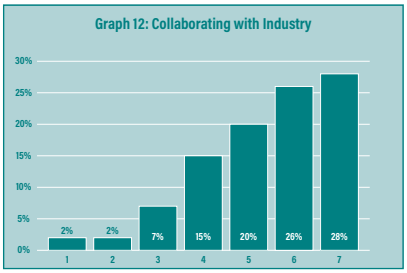
"What are the things you liked about your involvement in this program".

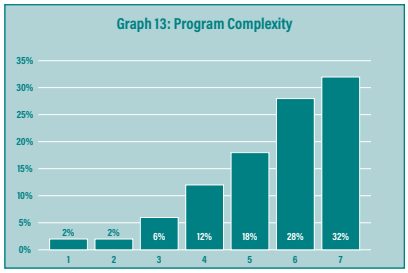
The responses were collected using a Likert scale with the following characteristics: 1: Corresponds not at all, 2: Corresponds a very little, 3: Corresponds a little, 4: Corresponds moderately, 5: Corresponds enough, 6: Corresponds a lot, 7: Corresponds exactly.

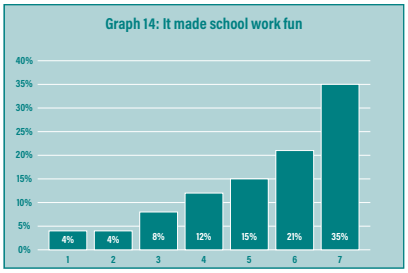
Responses on the Likert scale of 4 and above are considered positive.

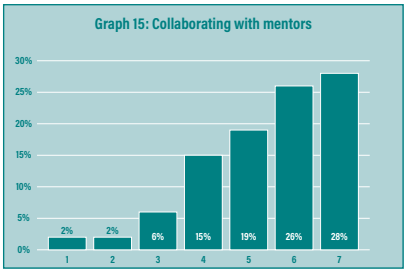


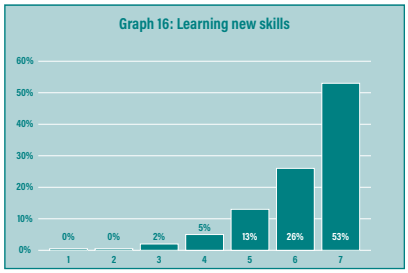


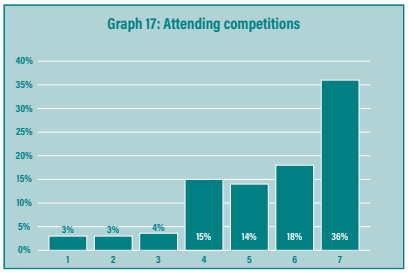


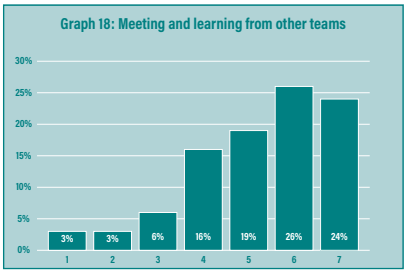


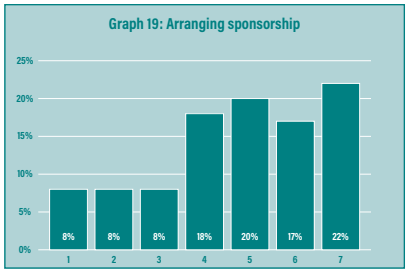


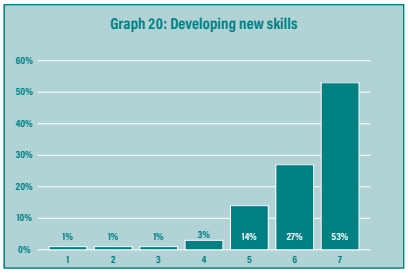


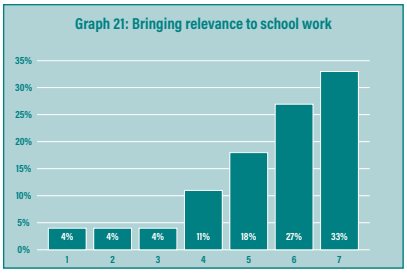












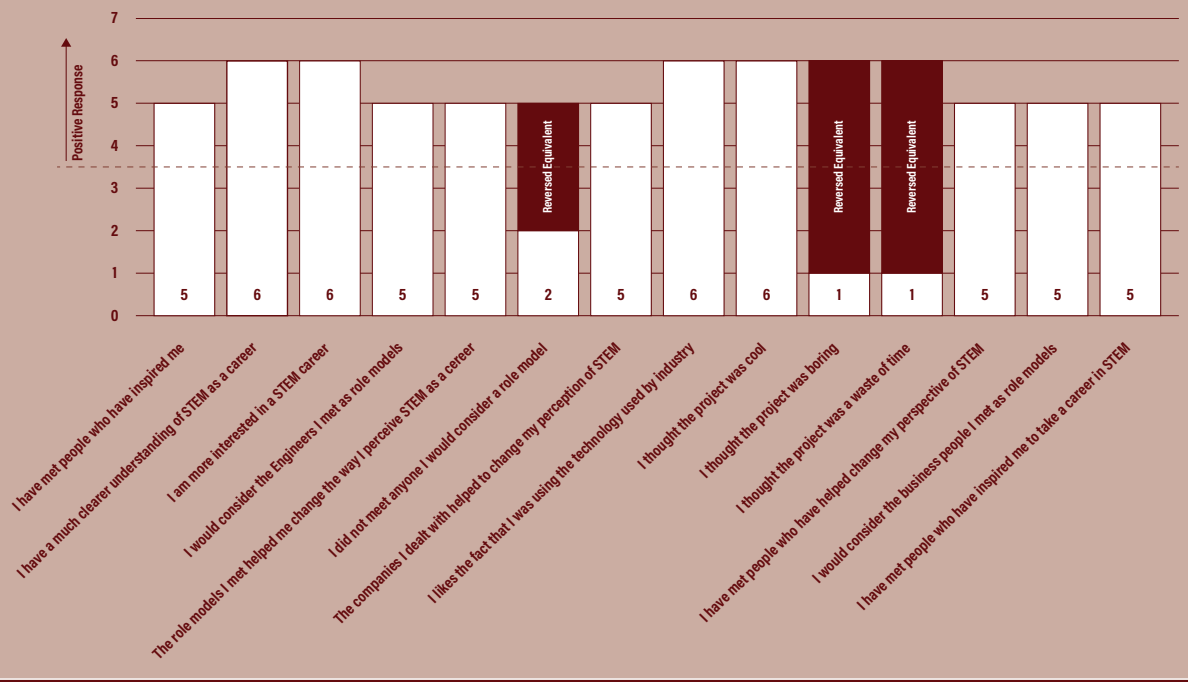
INFLUENCE OF OTHERS

We sought to understand others' influence via the "Influence of Others on Academic and Career Decisions Scale" **IOACDS** (Nauta and Kokaly, 2001). Several theories attempt to explain how role models influence career development, Bandura's Social Learning Theory (Bandura, 1969, Bandura, 1977, Bandura, 1982, Bandura, 1986, Bawden, 1991), Hackett & Betz (Hackett and Betz, 1981a). What seems to be common themes across these theories is that role models are other persons who, either by exerting some influence or simply by being admiral (cool) in one or more ways, impact another (Nauta and Kokaly, 2001).

The questionnaire also sought to measure the impact the program had on their understanding of STEM careers, the role of heroes and role models they met, and their perspective on the program's "coolness" and "boringness". This part of the questionnaire consisted of 14 two-stage quantitative questions containing a common primary element and a secondary element. e.g. "As a result of your involvement in an REA program, how do the following questions correspond for you?" (primary component) and "I have met people who have inspired me?" (secondary element).

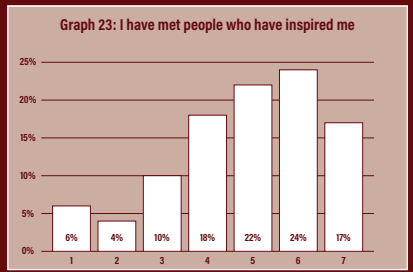
The responses were collected using a 7 point Likert scale with the following characteristics: 1: Corresponds not at all, 2: Corresponds a very little, 3: Corresponds a little, 4: Corresponds moderately, 5: Corresponds enough, 6: Corresponds a lot, 7: Corresponds exactly.

Graph 22: Influences of Others - Median Score - 7 point Likert scale

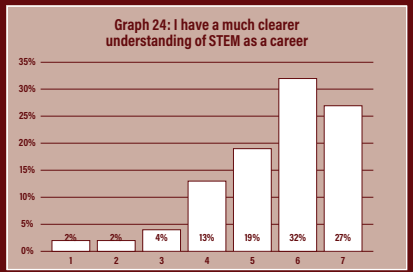


Graph 22 is of the median responses across all questions. Graphs 23 -36 show detailed answers to each question.
Graphs 37 & 37a are responses to very specific questions about the impact of the programs and students career motivations after completing the program.

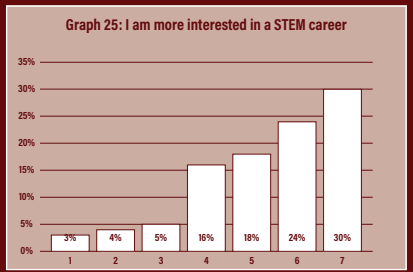
Graph 23: I have met people who have inspired me



Graph 24: I have a much clearer understanding of STEM as a career

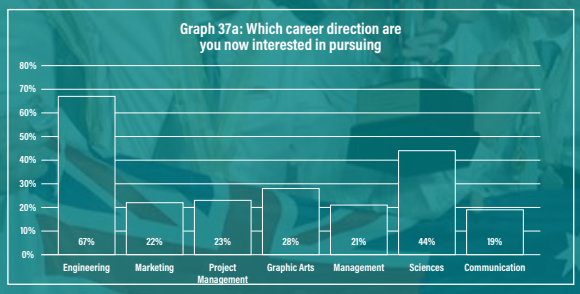


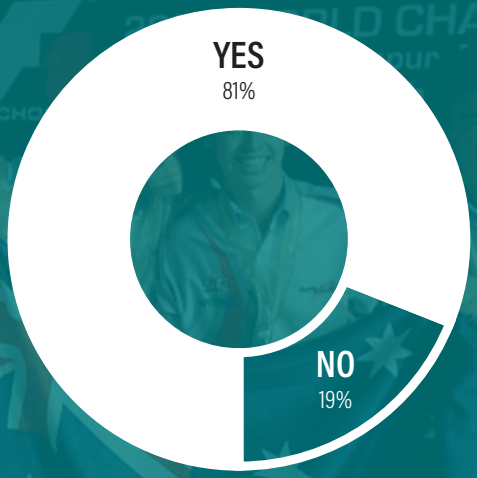
Graph 25: I am more interested in a STEM career

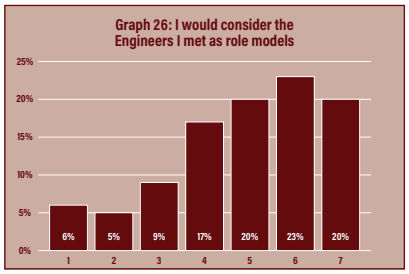


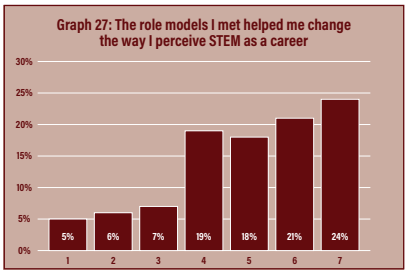
Did participation change your motivation to follow a STEM career?

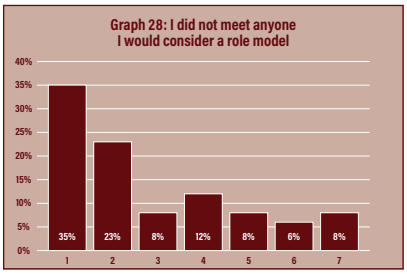
Graph 37

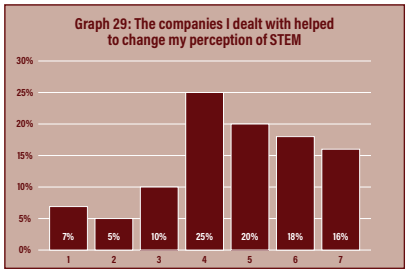


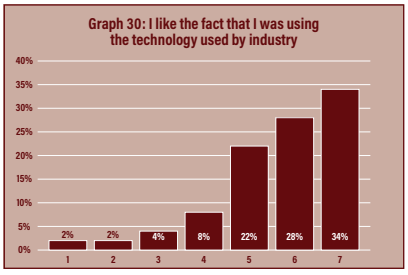


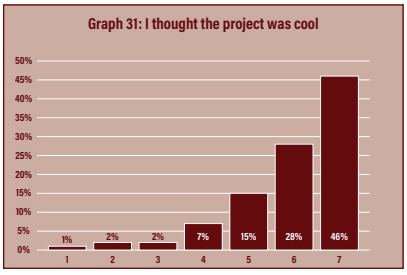


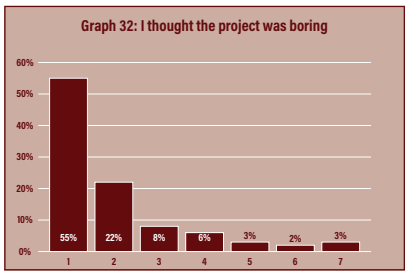


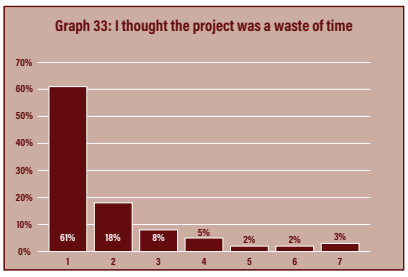


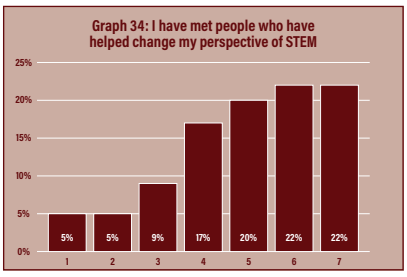


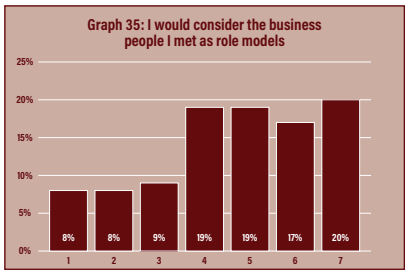


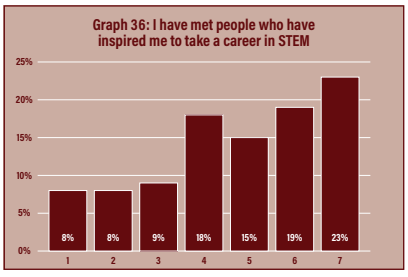






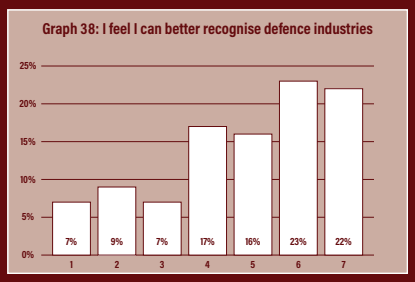


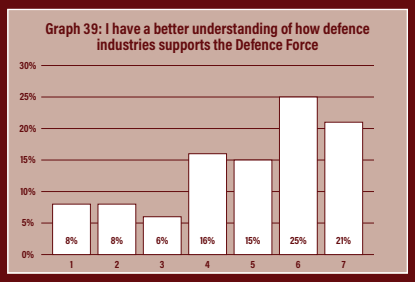


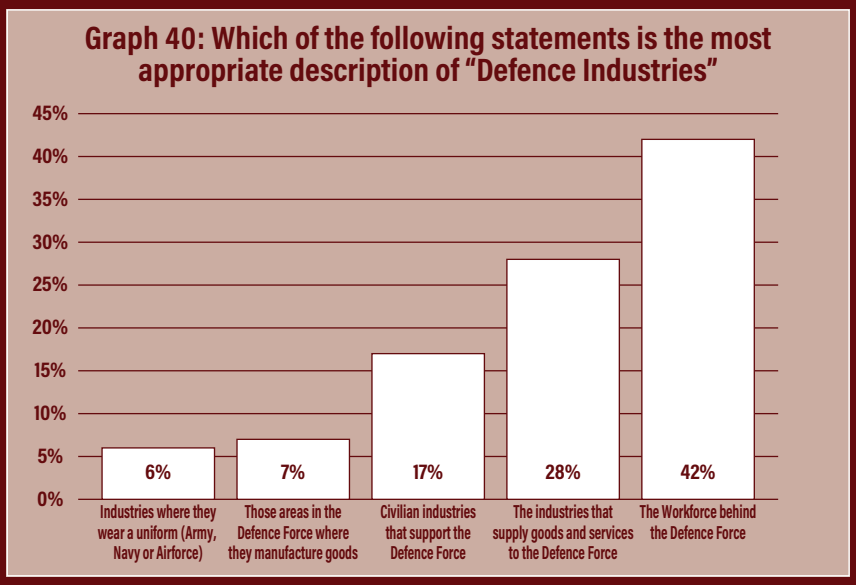


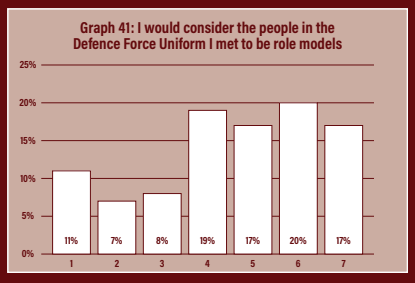
STUDENT INTEREST IN CAREERS IN DEFENCE

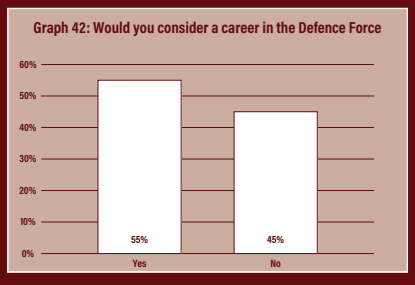
A vital part of the Government's long-term vision is building and developing a robust, resilient and internationally competitive Australian defence industrial base. The Governments' investment in Defence and Defence shipbuilding, in particular, will generate significant new career opportunities into the future. Students were asked about their knowledge of Defence and Defence industries, their interest in careers in these areas and sought to highlight perceived blockages the students may have to choose jobs in these areas. Graphs 38 - 46 are the responses to these questions.





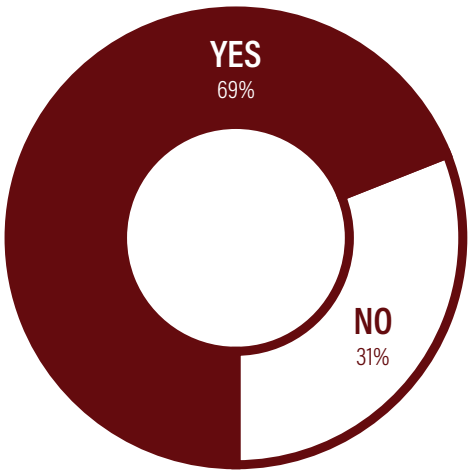


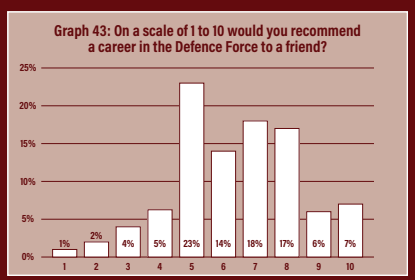


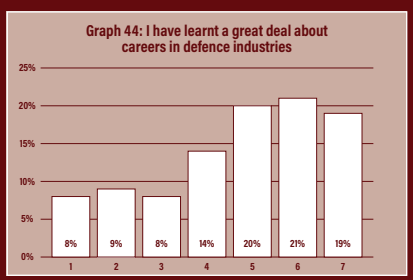


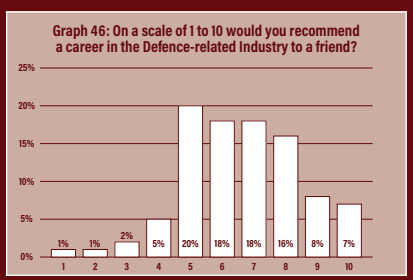
Would you consider a career in a Defence related industry?

Graph 45



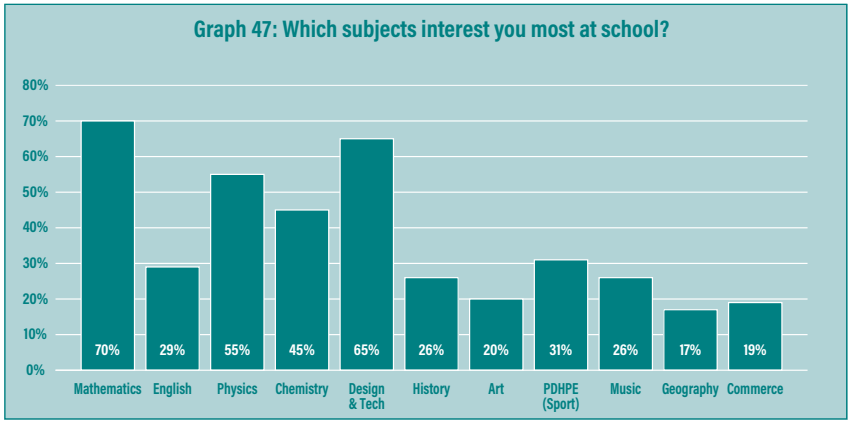




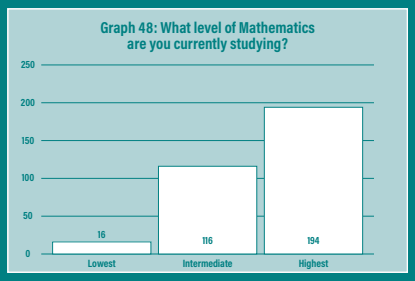


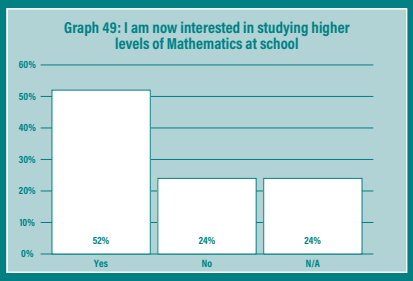
IMPACT ON SUBJECT SELECTION AT SCHOOLS

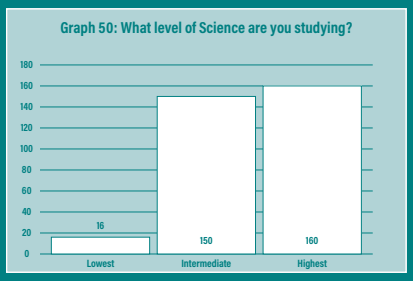
A set of questions were asked about the subjects students are studying at schools, their interest in key subjects such as Maths and Science and the impact of the program on their subject selection at school.

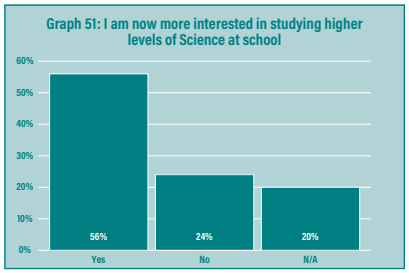


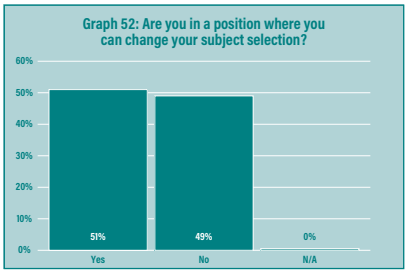
KEY DATA

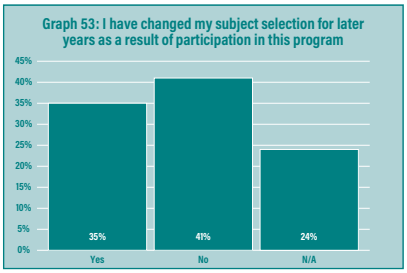


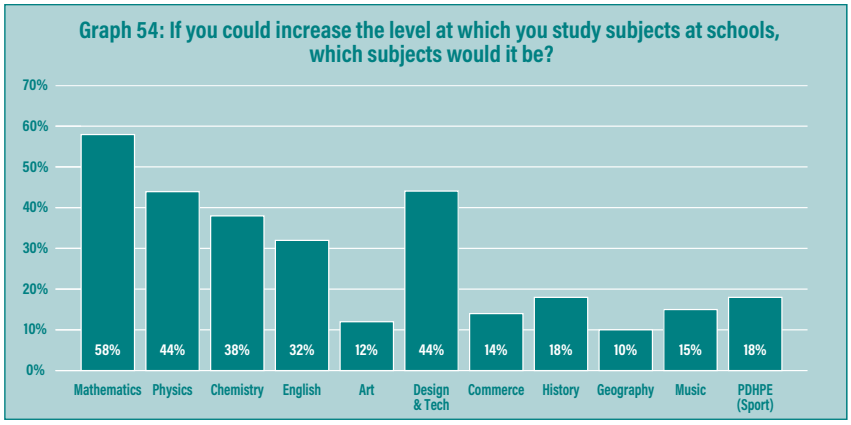


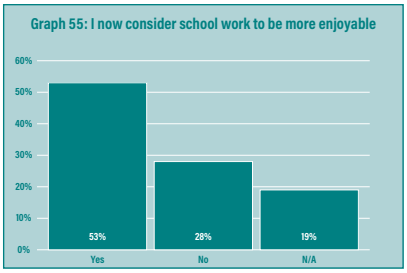








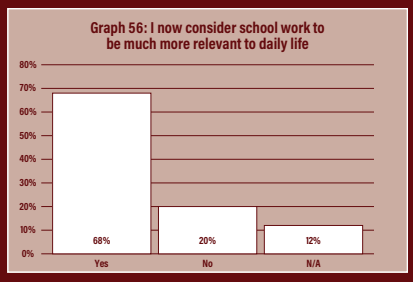


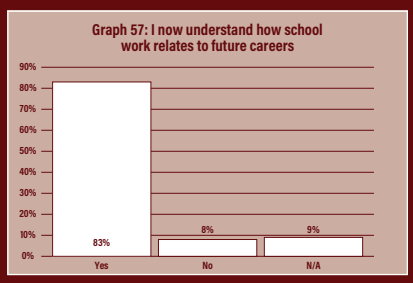


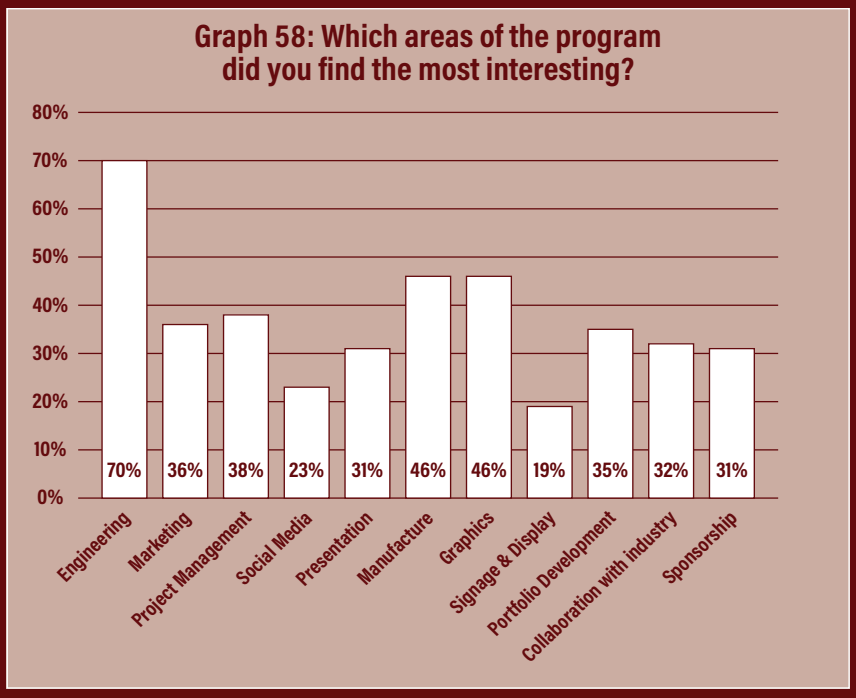
PROGRAM RELEVANCE

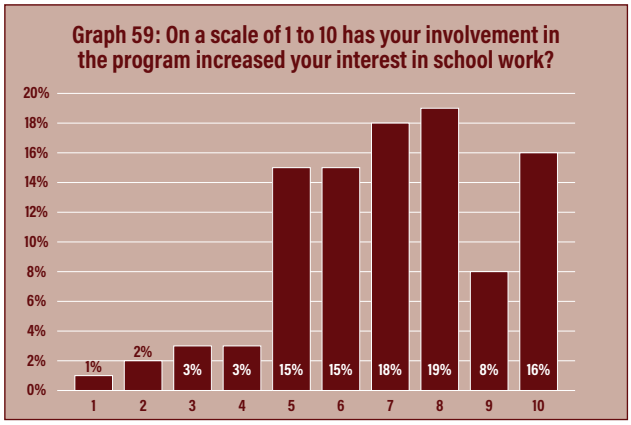
Students were asked a set of questions on the relevance of the program they participated in and the impact it had on their attitudes to a future career.

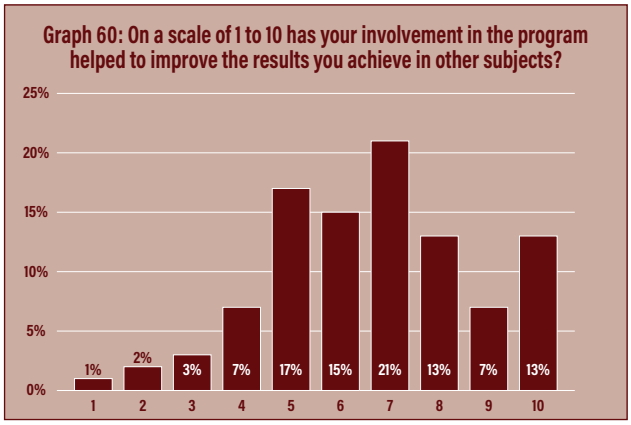
KEY DATA









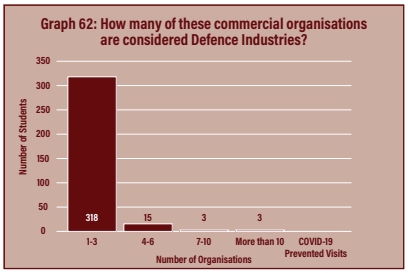


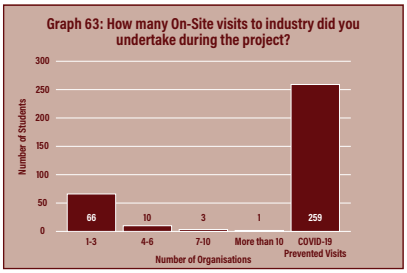
STUDENTS ENGAGEMENT WITH INDUSTRY

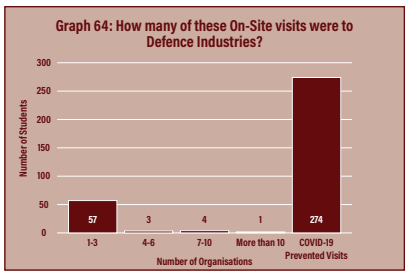
A fundamental and critical differentiator of the REA programs has been the requirement for students to work directly with industry partners in the context of their projects. Students have the opportunity to see a direct relevance between classroom activity they enjoy and the world of work. Besides the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

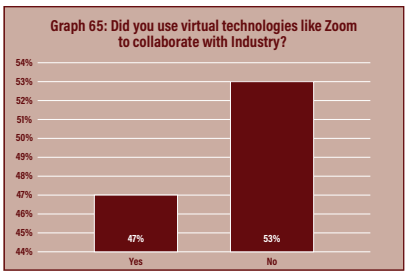
The questionnaire also sought to determine the level of interaction with Industry throughout the year. Unfortunately, due to COVID-19, students' opportunity to interact directly with Industry was limited to virtual engagement via Zoom or similar conferencing techniques.

Graphs 61-65, highlight the students' responses to their interaction with Industry during 2020.





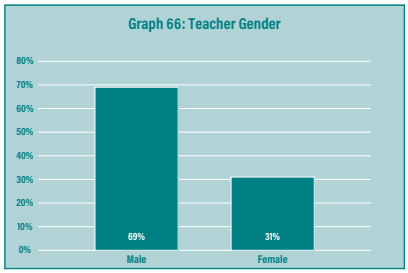


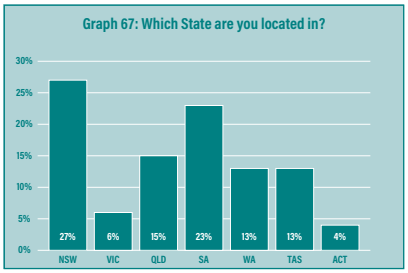


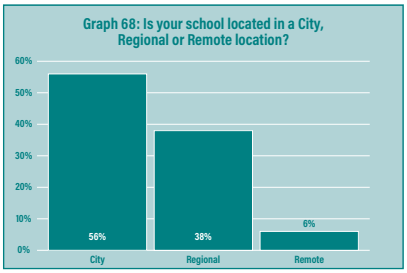
TEACHER DEMOGRAPHICS

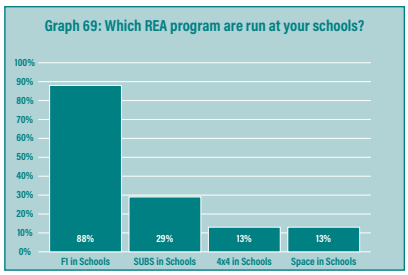
Teachers who participated in the survey were involved in one or more of REA's programs (F1 in Schools, SUBS in Schools, 4x4 in Schools, Space in Schools). The teachers were selected based on teams' participation in the STATE or National final events hosted between October and December 2020. We surveyed 57 teachers from 49 schools. Of these, 49 responses were valid with teachers answering all questions.

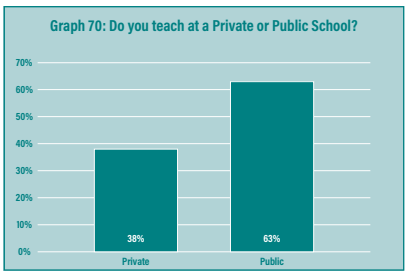
The following Graphs 66-75 highlight the demographic distribution of the teachers involved in the research survey.

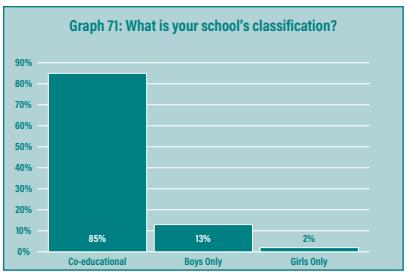


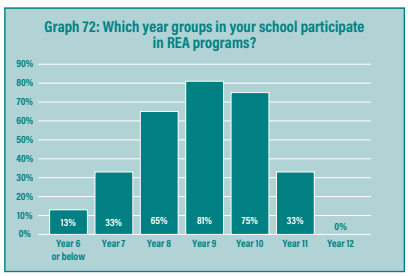


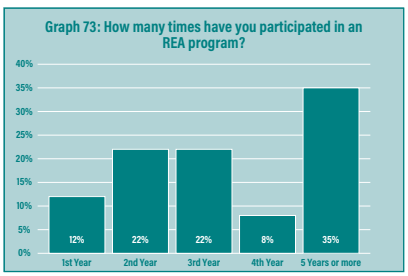


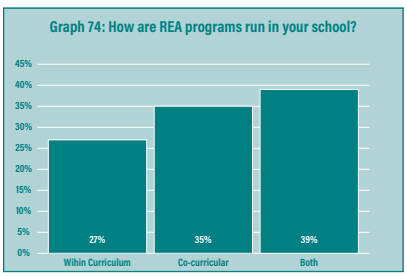


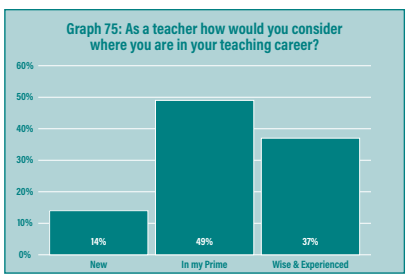






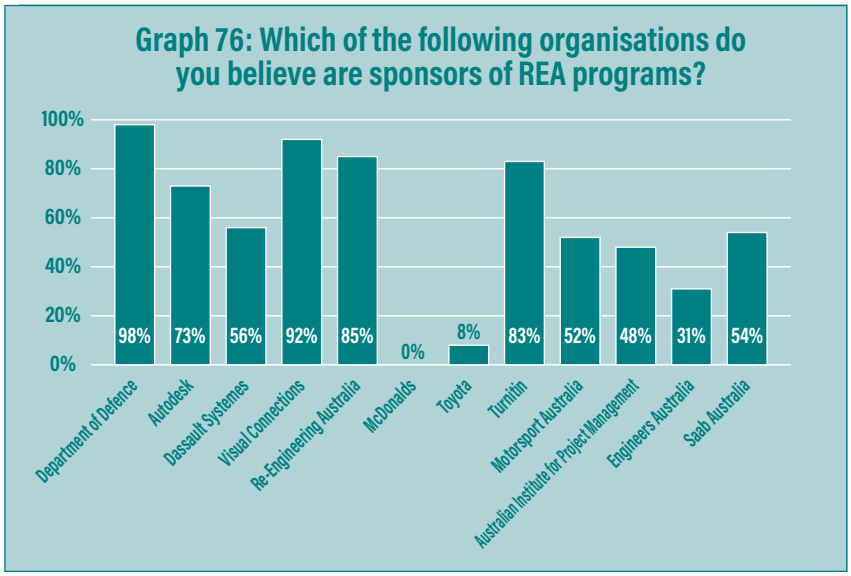


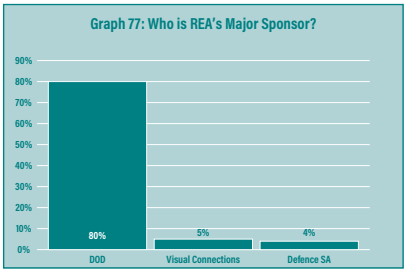


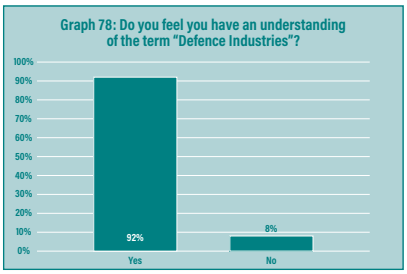


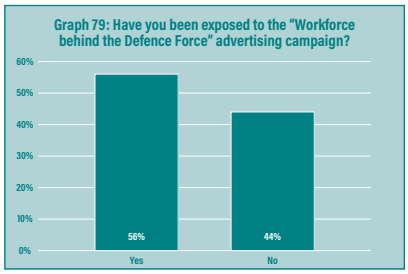
TEACHER RECOGNITION OF DEFENCE INDUSTRIES

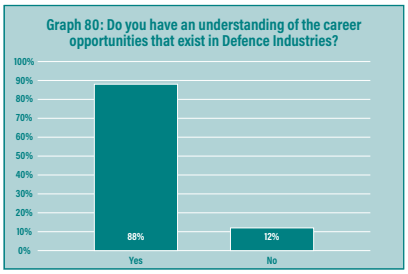
Critical to increasing students' exposure to employment pathways in Industry such as Defence Industries is the need to raise teachers' awareness and understanding of these career pathways. As part of the survey, we sought to determine the understanding teachers have of Defence Industry career pathways and if the career research the students were undertaking impacted teacher knowledge.

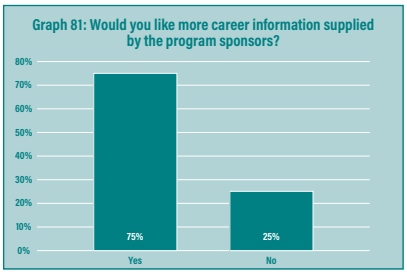


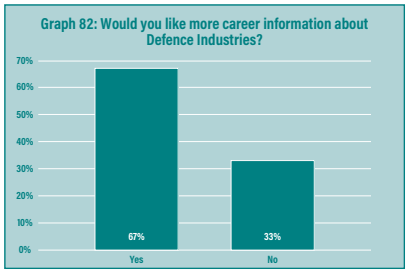


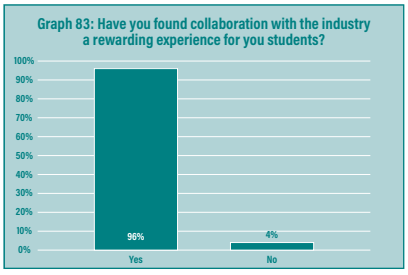


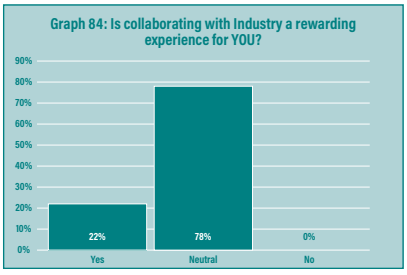










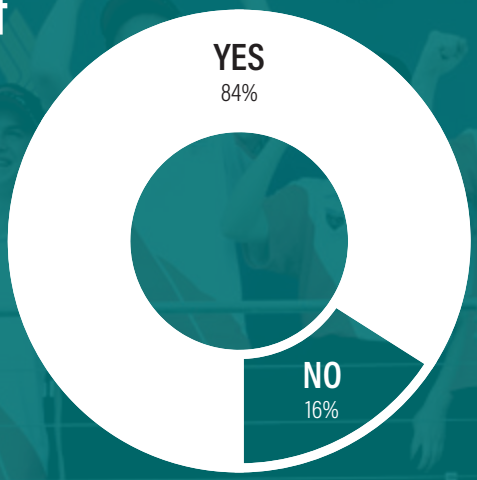


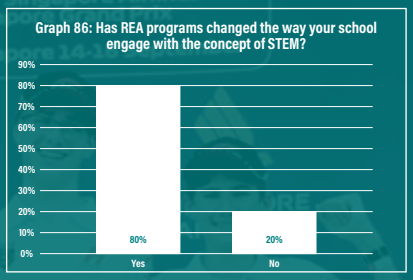
SCHOOL ENGAGEMENT WITH STEM & REA ACTIVITIES

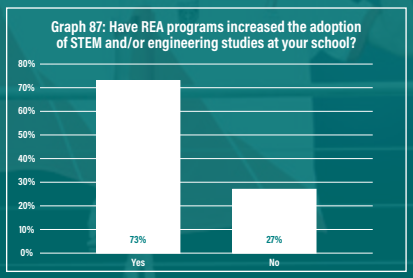
Teachers reported on levels of engagement by students in their schools, measurable change in attitudes toward STEM education in both the students and the school and the impact on teacher attitudes toward engagement.

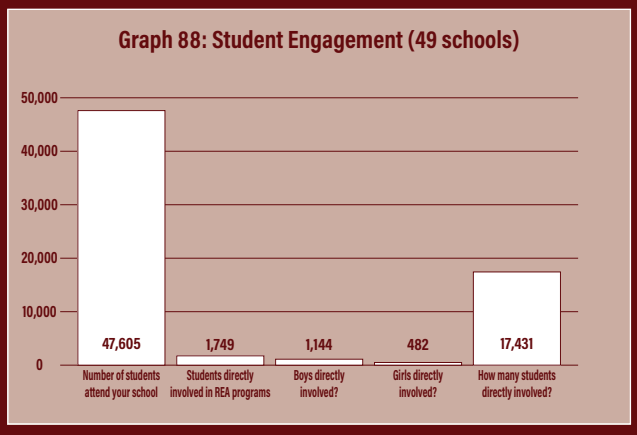
Have REA programs changed the perception of STEM education in your school?

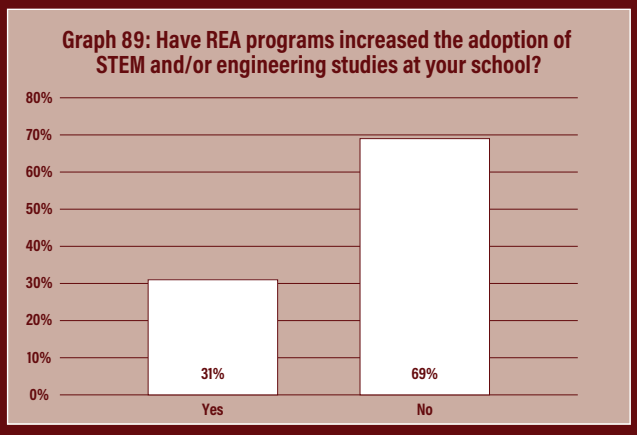
Graph 85

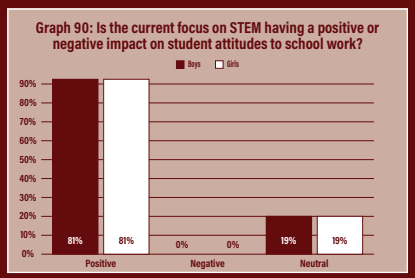


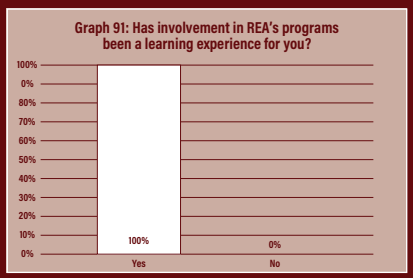


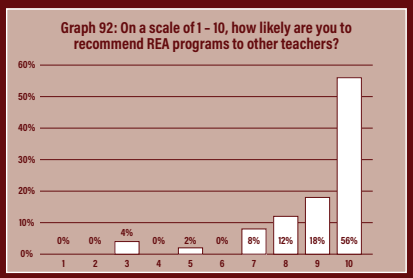








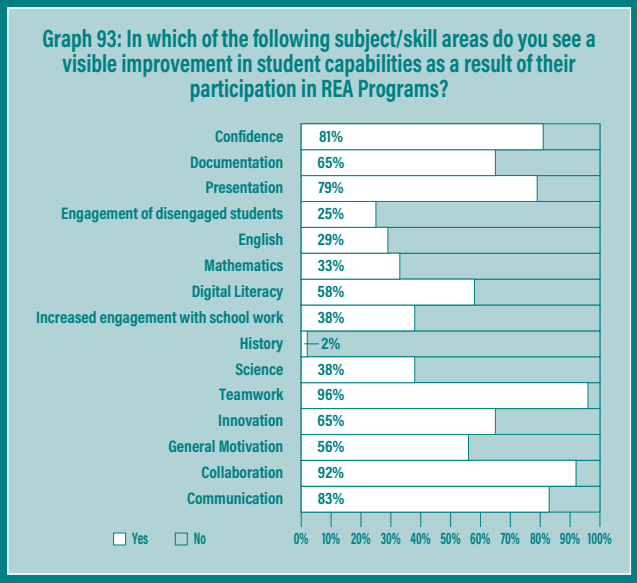


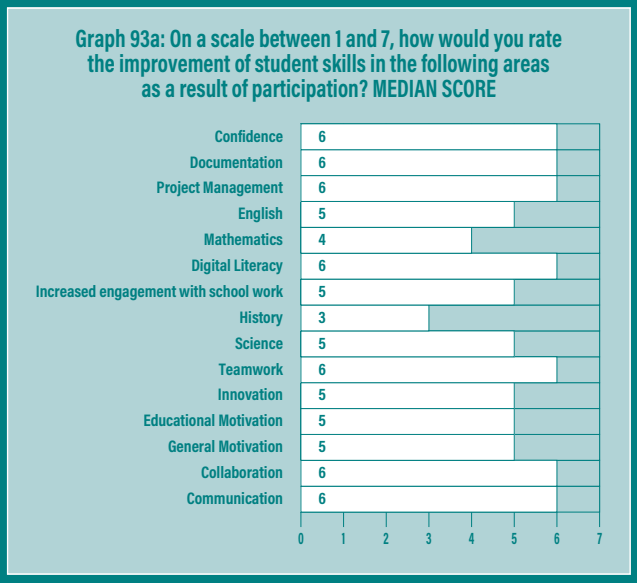


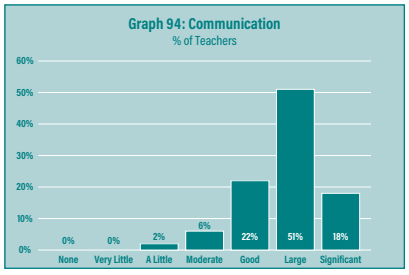
IMPACT OF REA PROGRAMS ON LEARNING OUTCOMES

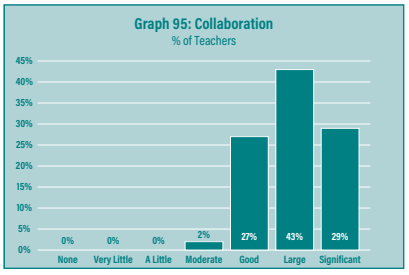
Teachers were asked to provide feedback on the improvement in educational attainment of their students as a result of participation. The following Graphs 93-109 highlight the teachers' response to these questions.

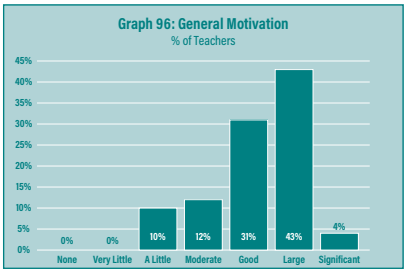
KEY DATA

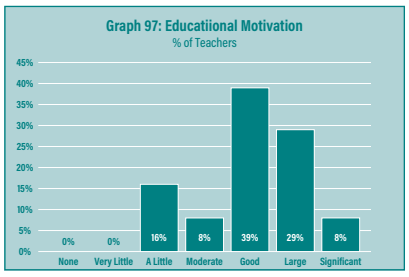


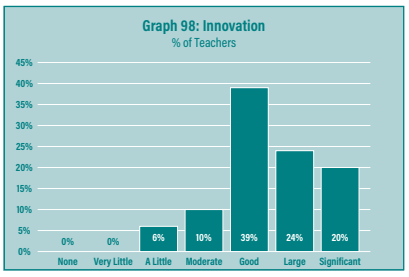


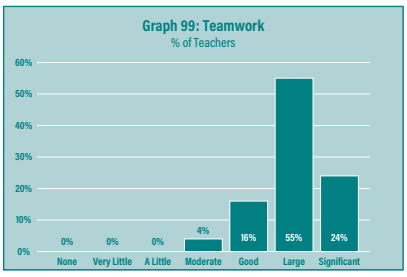


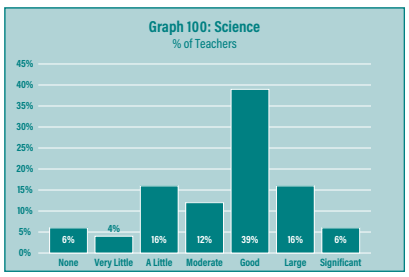


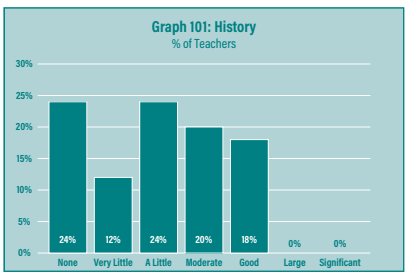


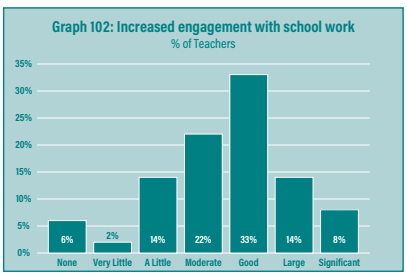


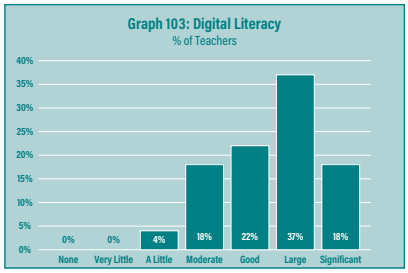


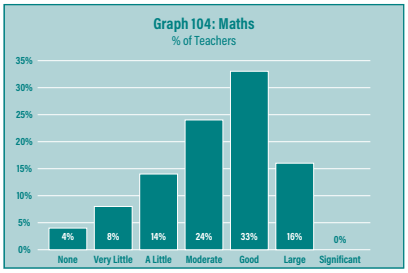


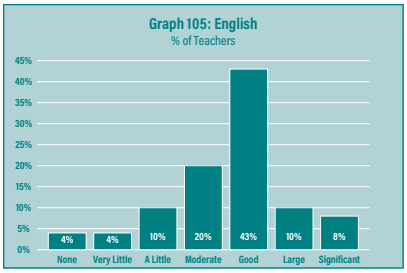


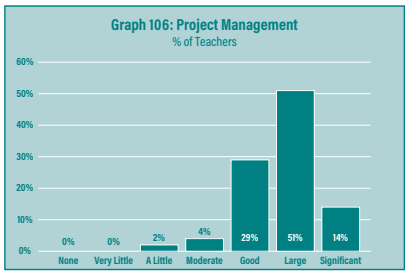


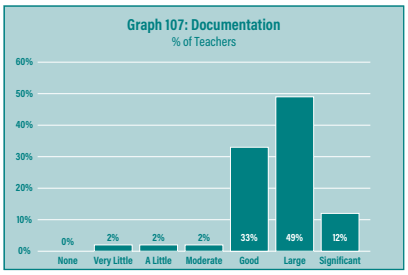


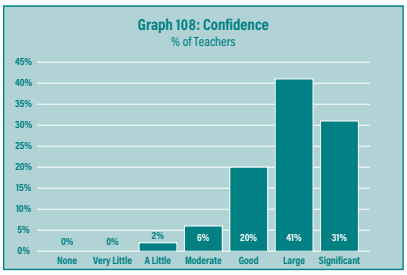


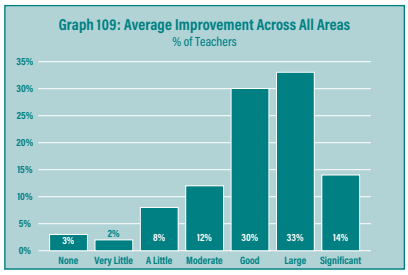






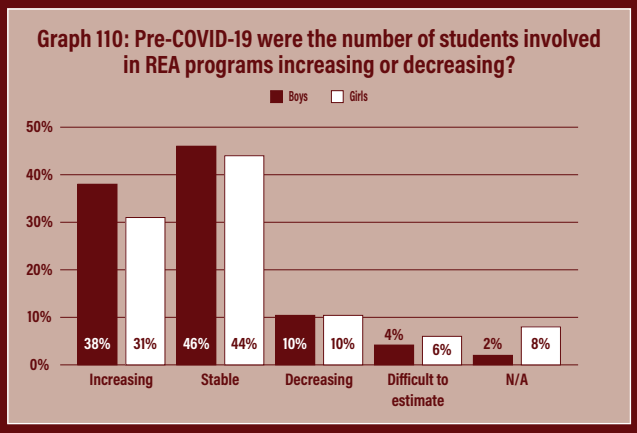


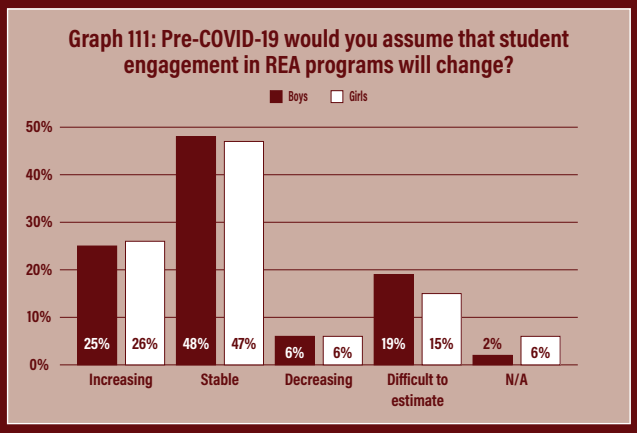




IMPACT OF COVID-19

Teachers were asked to provide feedback on the take-up of REA programs for both boys and girls in their schools pre and post COVID-19. The following Graphs 110-111 highlight their responses.





REA PROGRAM INFLUENCE ON GENDER PARTICIPATION

Students currently need significant support to discover just how exciting and engaging the activities of Industry can be. Learning environments that facilitate an increased understanding of career pathways that fit with Boys and Girls different motivational drivers will 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 and industries classified as being STEM-based.

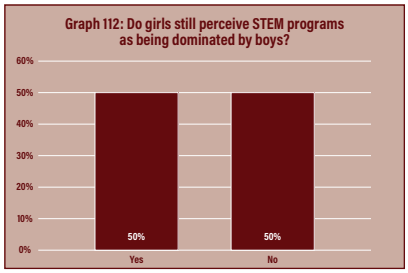
The longitudinal research has previously highlighted that the story about STEM needs to be told differently to Boys than to Girls. Boys have shown to learn by apprenticeship and respond to the influence of role models. The research would indicate that they need continuous human interaction with role models and mentors to perform at their peak. They need to make contact physical with a career before making an emotional decision about that career engagement. The movement of Boys into professions will increase when we can increase interaction between students and adults in industry roles. Boys appear to seek out career pathways where there will always be people around them who will help them learn and grow. Careers for boys should embrace a continual learning environment.

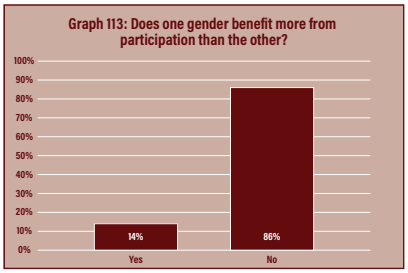
Correctly targeted interventions can bring about a dramatic change in the number of girls interested in specific industry careers. The longitudinal research has highlighted that the primary driver for Girls is a desire to respond to managing complexity in environments. Highlighting the processes and complexity involved in career pathways will attract them to professions. They thus react positively to the project management aspects of careers and seek to understand the processes involved in a job before moving in that direction.

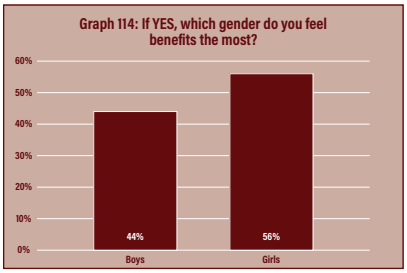
While understanding the difference in the messaging needed to attract boys and girls to careers, we do this without creating differentiation based on ethnicity, diversity, age or religion. We offer equal opportunity to all students and see no reasons to highlight blockages to career path selection.

While there has existed a perception that boys dominate STEM activities, using language that the students, boys and girls, can relate to, we have seen this perception dissipate over time.

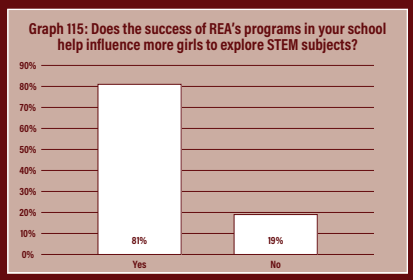
Graphs 112-115 highlight teacher responses to questions about the impact of the programs on gender acceptance.







KEY DATA



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. All REA programs require students to collaborate and interact with industry and industry mentors to learn about technology and career path options. Students have the opportunity to see a direct relevance between classroom activity they enjoy and the world of work.

Besides 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.

To increase student engagement with Industry, REA has adopted a strategy that requires students to seek information about possible career pathways that aligns with their skills and motivations.

The assessment regime involved in each of the programs has students dedicating a portion of their project presentations and project portfolio to highlighting their career research.

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.

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
Australian Government Department of Education
IBM
Regional Development Australia
eim ENGINEERING IN MOTION.
DATEA
TOYOTA PARTS SERVICE
DASSAULT SYSTEMES
JETTA
DEFENCESA
BAE SYSTEMS
State Government Victoria
BOEING
royal adelaide SHOW
ResMed
DEAKIN UNIVERSITY AUSTRALIA
UNIVERSITY OF TECHNOLOGY SYDNEY
THALES
Cummins
AMTIL
ACS
WESTERN SYDNEY UNIVERSITY
McLaren
DCNS
Cochlear
CONSULT AUSTRALIA
LAND ROVER
UNSW@ADFA CANBERRA AUSTRALIA
AUTODESK
Government of South Australia
ENGINEERS AUSTRALIA
JAGUAR
babcock trusted to deliver
University of South Australia
SAAB
BELL BAY ALUMINIUM PACIFIC ALUMINIUM
Australian Institute of Project Management
ASC
CQUniversity AUSTRALIA
NORDON CYLINDERS
ansto
QMISOLUTIONS
UNSW CANBERRA
BOSCH
Proudly Supported by Australian Government Department of Industry
DST GROUP
Medtronic Further, Together
QUT Queensland University of Technology
QINETIQ
NSC NAVAL SHIPBUILDING COLLEGE
UNIVERSITY OF TASMANIA AMC Australian Maritime College
motorsport australia
Regional Development Australia HUNTER ME PROGRAM
Government of South Australia
SOUTH AUSTRALIAN SPACE INDUSTRY CENTRE
Submarine Institute of Australia
turnitin
University of South Australia
Department of Education Marine Industries School Pathways Program

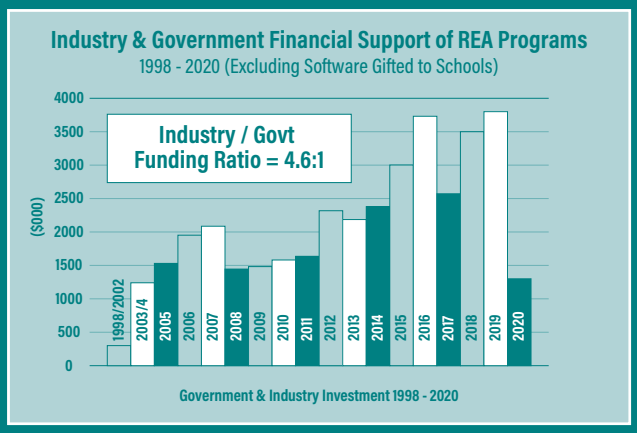
EXPOSURE

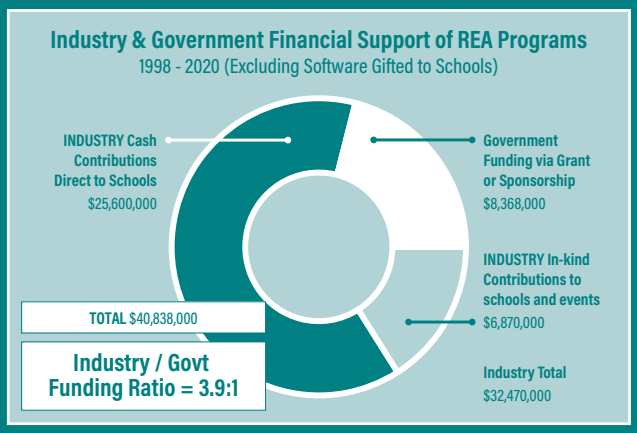
> Over many years there have been significant opportunities to gain exposure to the activities of the students. The following images highlight a small proportion of the exposure achieved.

EXPOSURE

CORPORATE PHILANTHROPY

> **Industry investment in REA programs has been significant between 1998 & 2020: above $40 million. The majority of this has directed to supplying Technology into schools, assisting with developing students' and teachers' skills, and providing students and teachers opportunities to travel to State and National Events.**





APPENDIX TEACHER FEEDBACK

Teachers were asked to provide their feedback to the following question:

"What are the positive aspects of REA's programs which stand out for YOU as a teacher?"

- Team work and documentation.
- Outcome based learning.
- Hands-on learning and an emphasis on teamwork.
- Students have to think about all of the aspects of their build for the documentation.
- Excellent mentoring from SAAB.
- A real World Challenge.
- Real world applications.
- Giving students experience with how projects are run in the real world as well as an opportunity for students to utilise skills from many different disciplines.
- The communication between students, staff within your own school and in collaborations.
- The visits from mentors to the school provide real world industry knowledge.
- Site visits enabled the students to see what happens in these industries.
- The teamwork and problem-solving skills that students develop.
- Life skills.
- Hands on/real world problem solving.
- REA programs encourage entrepreneurial thinking and co-operation.
- Team work and collaboration
- Hands on, relevant to career opportunities, real life, deadlines, collaboration.
- Student led project. Industry collaboration.
- All aspects
- The fact that the students can innovate beyond their years.
- The adaptation of concepts into reality and their capacity to problem solve.
- Their drive and willingness to take on such a massive challenge in an arena with students older than them has been phenomenal.
- The capacity of the students to build relationships with mentors is profound.
- Watching, for example, watching members of Celestial 2020/21 World team being mentored by members of 2014 World team Gamma Ray-cing and now to see Fast Fusion being mentored by Celestial - it's an unbelievable legacy.
- The Macarthur Hub is going from strength to strength. All teams involved in this State level competition were so supportive of each other - the F1 in Schools program has put students from Years 5 through to Year 12 in a high pressure, high stakes melting pot and the outcome has been immense academic growth and exponential development of the 'soft skills'. Thank you REA for providing this opportunity for our students!
- The practical nature and the rigour of the program.
- Engagement, project management, connection with industry, growing confidence, Increased STEM knowledge
- Collaboration and involvement with 'outside' world – i.e. industry
- Seeing student do something they enjoy.
- Attention to detail. Extensive feedback.
- Everything!!!!
- Increased confidence in students.
- The scaffolding and the real-world interaction.
- Students learning to communicate with industry, the increase in confidence, real world experiences.
- Teamwork, digital development of skills and knowledge, confidence of students in their own abilities.
- Global team work and initiative.
- I love REA programs. F1 in Schools and now Space in Schools is having a hugely positive impact on our school, and our community. Students who started F1 in Schools in 2017 at Joseph Banks as Year 9s (a bumpy year as we established the program here) graduated from Year 12 and many of the students are now perusing Engineering, CAD and design at their universities next year. I have no doubt REA programs played a role in them perusing that as a career pathway. REA programs have given our current students at Joseph Banks a chance to excel and shine.
- The REA runs by far the greatest STEM challenges for school students in the World. Just great to be a part of it.
- Thank you! Your dedication this year has been over and above. Your commitment has not gone unnoticed - Thank you!

BIBLIOGRAPHY

AKERLOF, G. A. 1983. Loyalty Filters. The American Economic Review, 73, 54-63.

BANDURA, A. 1969. Social learning theory of identification process., Chicago, Rand McNally.

BANDURA, A. 1977. Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

BANDURA, A. 1982. Self-efficacy mechanisms in human agency. American Psychologist, 37, 122-147.

BANDURA, A. 1986. Social Foundations of Thought and Action: A Social Cognitive Theory., Englewood Cliffs, NJ, Prentice Hall.

BETSY BLUNSDON, K. R., NICOLA MCNEIL, STEVEN MCEACHERN 2003. Experiential Learning in Social Science Theory: An investigation of the relationship between student enjoyment and learning. Higher Education & Development, 22, 43-56.

BETZ, N. E. 2000. Self-Efficacy Theory as a Basis for Career Assessment. Journal of Career Assessment, 8, 205.

BETZ, N. E. & HACKETT, G. 1986. Applications of self-efficacy theory to understanding career choice behavior. Journal of Social & Clinical Psychology, 4, 279-289.

BETZ, N. E., HAMMOND, M. S. & MULTON, K. D. 2005. Reliability and Validity of Five-Level Response Continua for the Career Decision Self-Efficacy Scale. Journal of Career Assessment, 13, 131-149.

BETZ, N. E. & KLEIN, K. L. 1996. Relationship among measures of career self-efficacy, generalized self-efficacy, and global self-esteem. Journal of Career Assessment, 4.

BETZ, N. E., KLEIN, K. L. & TAYLOR, K. M. 1996. Evaluation of a short form of the Career Decision-Making Self-Efficacy Scale. Journal of Career Assessment, 4, 47-57.

BISHOP, J. H., BISHOP, M. & BISHOP, M. 2003. Make Middle-Schoolers COOL with School Success. Education Digest, 69, 51-53.

BISHOP, J. H. & BISHOP, M. M. 2007. A Neo-Darwinian Rational-Choice Theory of Academic Engagement Norms: The struggle for Popularity and Normative Hegemony in Secondary Schools.

BLUNSDON, B., REED, K., MCNEIL & MCEACHERN, S. 2003. Experiential Learning in Social Science Theory: An investigation of the relationship between student enjoyment and learning. Higher Education & Development, 22, 43-56.

BOURNER, T. 2011. Developing self-managed action learning (SMAL). Action Learning: Research & Practice, 8, 117-127.

BROWN, S. D. & LENT, R. W. 1996. A social cognitive framework for career choice counseling. The Career Development Quarterly, 44, 354-366.

CARRINGTON, B., TYMMS, P. & MERRELL, C. 2008. Role models, school improvement and the 'gender gap'—do men bring out the best in boys and women the best in girls? British Educational Research Journal, 34, 315-327.

COHEN, B. N. 2003. Applying Existential Theory and Intervention to Career Decision-Making. Journal of Career Development, 29, 195.

COLLINS, C., KENWAY, J. & MCLEOD, J. 2000. Factors influencing the educational performance of males and females in school and their initial destinations after leaving school. Department of Education, Training and Youth Affairs. Canberra.

DECI, E. L. & RYAN, R. M. 1985. Intrinsic Motivation and Self-determination in human behavior, New York, Plenum.

DEST 2005. Survey of Vocational and Technical Education (VET): Participation, Triggers, Perceptions and Aspirations. Australian Government.

FARMER, H. S. 1985. Model of career and achievement motivation for woman and men. Journal of Counseling & Psychology, 33, 363-390.

FARMER, H. S. 1987. A multivariate model for explaining gender differences in career and achievement motivation. Educational Researcher, 16, 5-9.

FARMER, H. S. 1997. Women's motivation related to mastery, career silence, and career aspiration: A multivariate model focusing on the effects of sex role socialization. Journal of Career Assessment, 5, 355-374.

GUAY, F., VALLERAND, R. J. & BLANCHARD, C. 2000. On the Assessment of Situational Intrinsic and Extrinsic Motivation: The Situational Motivation Scale (SIMS). Motivation & Emotion, 24.

HACKETT, G. & BETZ, N. E. 1981a. A Self-Efficacy Approach to the Career Development of Women. Journal of Vocational Behavior, 18, 326-339.

HACKETT, G. & BETZ, N. E. 1981b. A self-efficacy approach to the career development of women. Journal of Vocational Behavior, 35, 164-180.

HACKETT, G. & BETZ, N. E. 1992. Gender, ethnicity, and social cognitive factors predicting the academic achievement of students. Journal of Counseling Psychology, 39, 527.

HACKETT, G. & BYARS, A. M. 1996. Social cognitive theory and the career development of African American woman. The Career Development Quarterly, 322-340.

HACKETT, G., ESPOSITO, D. & O'HALLORAN, M. S. 1989. The Relationship of Role Model Influences to career Salience and Educational and Career Plans of College Women. Journal of Vocational Behavior, 35, 164-180.

JUNG, J. 1986. How useful is the concept of role model?: A critical analysis. Journal of Social Behavior and Personality, 1, 525-536.

KOLB, D. 1984. Experiential Learning: Experience as the source of learning and development, New Jersey, Prentis Hall Inc.

LENT, R. W., BROWN, S. D. & HACKETT, G. 1994. Toward a unifying cognitive theory of career and academic interest, choice, and performance. Journal of Vocational Behavior, 45, 79-122.

LENT, R. W., BROWN, S. D., SCHMIDT, J., LYONS, H. & TREISTMAN, D. 2003. Relations of contextual supports and barriers to choice behavior in engineering majors: Test of alternative social cognitive models. Journal of Counseling Psychology, 50, 458-465.

LIZZIO, A. & WILSON, K. 2004. Action Learning in Higher Education: an investigation of its potential to develop professional capability. Studies in Higher Education, 29, 469-488.

LOCKWOOD, P. & KUNDA, Z. 1997. Superstars and me: Predicting the impact of role models on the self. Journal of Personality and Social Psychology, 73, 91-103.

MARTIN, J. A. 2004. School motivation of boys and girls: Differences of degree, differences of kind, or both? Australian Journal of Psychology, 56, 133-146.

NAUTA, M. M., EPPERSON, D. L. & KAHN, J. H. 1998. A multiple groups analysis of predictors of career aspirations among women in science and engineering. Journal of Counseling Psychology, 45, 483-496.

NAUTA, M. M., KAHN, J. H., ANGELL, J. W. & CANTARELLI, E. A. 2002. Identifying the antecedent in the relation between career interests and self-efficacy: Is it one, the other, or both? Journal of Counseling Psychology, 49, 290-301.

N**AUTA, M. M. & KOKALY, M. L.** 2001. Assessing role model influences on students' academic and vocational decisions. Journal of Career Assessment, 9, 81-99.

PAA, H. K. & MCWHIRTER, E. H. 2000. Perceived influences on High School Students' Current Career Expectations. The Career Development Quarterly, 49.

PAULSEN, A. M. & BETZ, N. E. 2004. Basic Confidence Predictors of Career Decision-Making Self-Efficacy. Career Development Quarterly, 52, 354.

PETERSON, S. L. & DELMAS, R. C. 1998. The component structure of Career Decision-Making Self-Efficacy for under prepared college students. Journal of Career Development, 24, 209-225.

RYAN, R. M. 1999. Motivation for physical activity research on persistence, performance, and enjoyment in sport, exercise, and everyday life from a self-determination theory viewpoint. Journal of Sport & Exercise Psychology, Vol. 29, , pS2-S2, 1/3p.

RYAN, R. M. 2007. Motivation of Physical activity research on persistence, performance and enjoyment in sport, exercise and everyday life from a self determination theory viewpoint. . Journal of Sport & Exercise Psychology, 29, 1-3.

RYAN, R. M. & DECI, E. L. 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55, 68-78.

SONG, H.-D. & GRABOWSKI, B. 2006,. Stimulating Intrinsic Motivation for Problem Solving Using Goal-Oriented Contexts and Peer Group Composition. Educational Technology Research & Development, 54, p445-466.

TYLER, R., SYMINGTON, D. & SMITH, C. 2009. A curriculum Innovation Framework for Science, Technology and Mathematics Education.

VALLERAND, R. J. 1997. Toward a hierarchical model of intrinsic and extrinsic motivation., New York, Academic Press.

WATT, H. M. G. 2004. Development of Adolescents' Self-Perceptions, Values, and Task Perceptions According to Gender and Domain in 7th- through 11th-Grade Australian Students. Child Development, 75, 1556-1574.

WHITE, S. H. & O'BRIEN, J. E. 1999. What is a Hero? An exploratory study of students' conceptions of heroes. Journal of Moral Education, 28, 81-95.

WYNARCZYK, P. 2009. Providing the science, technology, engineering and mathematics skills of tomorrow. New Technology, Work & Employment, 24, 243-259.

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