



SUBMISSION TO THE

House of Representatives Standing Committee on Employment, Education and Training Inquiry into School to Work Transition

JULY 2017

The Australian Academy of Technology and Engineering (ATSE)¹ welcomes the opportunity to provide input into the House of Representatives Standing Committee on Employment, Education and Training Inquiry into School to Work Transition (the Inquiry).

ATSE is actively engaged in providing evidence based policy² into Australia's education system. ATSE considers Australia needs to improve its approach to science, technology, engineering and mathematics (STEM) education to underpin its prosperity, its capacity to meet national challenges and its global competitiveness. Improved quality and reach of STEM education are vital for sustainable wealth creation in Australia, which will be driven by science and technology.

In this context, ATSE has considered the necessary framework required to support students in their school to work transition and recommends that the Inquiry findings:

- Note the changing Australian work place and the needs of the current generation of students into the future;
- Promote curriculum design that meets the needs of students in future work scenarios, including ensuring maths is mandatory to year 12;
- Move to ensure initial teacher education and training for STEM teachers require a bachelor's degree, with appropriate STEM major; along with either undergraduate or postgraduate qualifications in teaching;
- Encourage interdisciplinary learning environments for STEM through recognition of the effectiveness of programs, such as ATSE's STELR program³; and
- Encourage investment in programs that promote careers that require STEM.

1. Introduction

ATSE's submission to the Inquiry focuses on item 2 and 3 in the Inquiry's terms of reference;

- 2. Opportunities to better inform and support students in relation to post-school education and training, including use of employment outcomes of students who undertake school-based vocational education or post-school tertiary pathways;*
- 3. Other related matters that the Committee considers relevant.*

The majority of the fastest growing occupations require significant STEM skills and knowledge. A 2015 PricewaterhouseCoopers survey⁴ reported that 44% of jobs currently in Australia will not exist in approximately 15 years. The report also predicted that 75% of the

¹ ATSE advocates for a future in which technological sciences, engineering and innovation contribute significantly to Australia's social, economic and environmental wellbeing. The Academy is empowered in its mission by some 800 Fellows drawn from industry, academia, research institutes and government, who represent the brightest and the best in technological sciences and engineering in Australia. The Academy provides robust, independent and trusted evidence-based advice on technological issues of national importance. ATSE fosters national and international collaboration and encourages technology transfer for economic, social and environmental benefit. www.atse.org.au

² ATSE's Education Forum has published Position and Action Statements as input into education policy. Information on this activity can be found at www.atse.org.au/education.

³ STELR (Science and Technology Education Leveraging Relevance) is a national initiative of the Australian Academy of Technology and Engineering (ATSE). www.stelr.org.au

⁴ PwC (2015) A smart move, PricewaterhouseCoopers Australia.

replacement jobs will require science and technology skills. These findings were supported by a CEDA study⁵, also released in 2015.

The workforce of the future will be fragmented and combine traditional roles with those emerging in entrepreneurial start-ups. Students that enter the workforce will need a combination of skills, both the 'softer' interpersonal skills and deep discipline knowledge to adapt to these opportunities. Over the next ten years, schools will specifically need to prepare students to work in a time where artificial intelligence and robotics are integrated into the workplace.

To better inform and support students in relation to post-school education and training, education pathways through primary and secondary schools need to ensure students have the foundation skills that will prepare them for the changing workforce. This will include a focus on STEM subjects combined with arts/humanities. Effective curriculum design is critical in ensuring this support is provided.

2. Curriculum design

2.1 Innovation in curriculums

In February 2017, ATSE held a forum, *Education for Innovation – creativity, professionalism and diversity* with the primary focus of examining education needs and opportunities, and how this related to curriculum design. While much of the discussion focused on tertiary education, key themes emerged that supported a 'whole of education' approach to enable students to prepare for jobs of the future. These included a:

- requirement for curricula to introduce an interdisciplinary, rather than a siloed, STEM focus;
- focus on active learning rather than passive learning;
- need to nurture and harness the creativity and curiosity of students, which thrives at primary school, right through to tertiary level;
- need to embrace student-led learning;
- need to build leaders;
- need to work with industry to inform future curricula, based on skills needs, for example;
 - communication and interpersonal skills;
 - collaborative skills;
 - creativity; and
 - initiative and ability to understand theory application in a business context.

These themes emerged from speakers and discussions across the 80 strong audience comprising key stakeholders from academia, government, industry and the education sector. A summary of the event can be found on ATSE's website⁶.

⁵ CEDA (2015) Australia's future workforce?, The Committee for Economic Development of Australia, Melbourne

⁶ Education for Innovation: Creativity, Professionalism and Diversity, 24th February 2017, <https://www.atse.org.au/content/education/education-innovation-creativity-professionalism-diversity.aspx>

An approach to curriculum design that includes these factors would assist students in their transition to post-secondary study or work. The work of the Center for Curriculum Redesign may assist in further informing the Inquiry in this regard⁷.

3. Increased focus on STEM education

3.1 Mandatory STEM to Year 12

Prerequisite knowledge of basic STEM concepts will increasingly be required by students to enable engagement in future education and training.

As a national priority students should be encouraged to complete a mathematics course at Year 12 level⁸. Mathematics is currently not compulsory to Year 12 in the national curriculum. This could undermine students' preparedness when transitioning from secondary school, as the absence of foundation mathematics is likely to reduce post-school education and training opportunities for the majority of jobs of the future, particularly should it be a prerequisite for entry into tertiary studies.

3.2 Discipline-trained teachers

Any increased focus on STEM based studies should combine with efforts to ensure teachers are appropriately STEM qualified, and programs that raise the status of STEM careers.

Evidence highlights the influence of inspirational teachers in a student's decision to progress with STEM studies. A report from the Australian Council of Learned Academies has found that countries that lead on STEM education and workforce skills have inspirational teachers who are well trained in a STEM discipline and in pedagogy. This can be achieved by ensuring teacher training includes a bachelor's degree with a relevant STEM major, combined with post-graduate teacher training qualifications⁹. The Academy has highlighted the importance of having discipline-trained teachers in its policy Action Statement *World leading STEM teachers for Australia*¹⁰ which is attached to this submission.

ATSE's State Divisions also operate a number of programs to encourage STEM education and the development of STEM teachers, for example the ATSE Science Teacher's Award in South Australia and the ATSE Young Ambassadors Program in Queensland.

3.3 Promotion of careers involving STEM

Programs that raise the awareness of potential career paths for students to ensure subjects such as physics, maths and chemistry are relatable to students' career aspirations is

⁷ Center for Curriculum Redesign, www.curriculumredesign.org

⁸ ATSE, Advancing STEM Education, September 2013

⁹ Australian Council of Learned Academies, Securing Australia's Future, STEM: Country Comparisons; International comparisons of science, technology, engineering and mathematics (STEM) education, May 2013

¹⁰ ATSE, World leading STEM teachers for Australia, December 2015



essential. ATSE is engaged in two projects that seek to encourage students to pursue STEM studies.

3.3.1 STELR

ATSE's STELR program aligns with the national curriculum and is an activity-based, interdisciplinary approach to STEM using equipment designed to increase the fun and effectiveness of hands-on activities. The program appeals to the student's appreciation of the relevance of science in their lives, which can often be under appreciated despite being surrounded by science and technology. It does this by aligning STELR modules with the high level of concern the majority of students have about global warming and climate change. Students work with concepts such as renewable energy and sustainable housing.

STELR is taught with the curriculum, so all students at the year level participate in the program, not just select students. ATSE's STELR program is currently operating in over 600 schools in Australia, reaching over 45,000 students and engaging over 1,500 teachers.

An independent evaluation of this program has shown an increase in enrolment in STEM subjects in year 11 and 12. Support of STELR through this Inquiry will further ensure the reach and effectiveness of this program and contribution to a school to work transition for the future.

3.3.2 Women in STEM and Entrepreneurship (WISE)

ATSE has recently been awarded a WISE grant to combine the in-school STELR programs with a project designed to raise the profile of successful women in STEM/Entrepreneurial careers. The project has commenced and will focus on engaging students, and inspiring girls to consider careers which require STEM, and inform their decisions around subject selection. The WISE project will profile through video and various media, the achievements of these women, their career and education pathways to highlight their success and the relevance of STEM in their roles.

4. Australia's technological readiness and future skills needs

Finally, ATSE is due to commence a multi-year project to assess the technological readiness and skills needs for Australia.

ATSE will develop a decadal plan for technology research in Australia that will explore the likely environment that Australian industry will need to adapt to by 2030, the readiness of key sectors of the Australian economy to adapt to this environment, and what industry sectors need to do to maintain or increase their competitiveness. The research needs of key industry sectors will also be identified. This decadal plan for technology research will help guide decisions by the research sector to ensure investment, and effort in workforce capabilities, are appropriately focussed to promote Australian industry competitiveness, thereby enabling collaboration between Australian industry and publicly funded research organisations. It will



also be a crucial tool to guide curriculum design to ready students in the transition to future work scenarios.

This study will focus on five key Australian industry sectors. Industry sectors will be chosen based on their critical importance to the Australian economy as a whole (e.g. transport, defence, energy, construction and healthcare).

ATSE will draw upon the outcomes of this project to further inform our approach to STEM education, and the findings of the project are likely to be relevant to addressing the issues identified by this Inquiry.

Members of ATSE's Education Forum are available, should the Committee require further information. The relevant contact at ATSE is Janine Rayner, ATSE Senior Research and Policy Officer