

Premier’s TAFE NSW Scholarship

Innovation to completion

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# Introduction

Creativity is an attribute that is highly desired by employers. It contributes to innovation and self-efficacy and, contrary to popular opinion, is something that can be both learned and taught. Creative problem solving is also critical to future career success in the age of automation. Employers are looking for people who can think on their feet and be innovative.

Several studies have been conducted on the types of skills wanted by employers, with quite similar results. According to Bloomberg’s Job Skills Report 2016 (Bloomberg, 2016), one of the top five skills in demand by technology industry employers is creative problem solving. It is listed as one of the hardest attributes to find, yet one of the most valuable.

Science, technology, engineering and mathematics (STEM) industries are the fastest-growing areas for jobs; by integrating art and technology, STEM becomes science, technology, engineering, art and mathematics (STEAM). STEAM teaches students to be problem solvers and designers, as well as how to work collaboratively, leading to innovation and creative thinking in the workplace.

TAFE NSW students must be encouraged to innovate and create their own future in technology. They need to become dynamic, flexible, collaborative problem solvers to meet employers’ needs. They also need to become more engaged and motivated, thereby ensuring that they complete their studies.

# Focus of Study

The initial focus of my study was on STEM partnerships between higher education institutions and businesses, and how these can contribute to innovative, creative students, motivated to complete their courses and be in demand by employers. These partnerships included startups, makerspaces, hackathons and design thinking. By investigating how these partnerships are being used in organisations and educational institutions, I wanted to learn how to enable TAFE NSW students to become creative problem solvers.

My study tour was based in the USA and chronicled in my blog, [Innovation to completion](https://innovationtocompletion.wordpress.com/). Part of my tour included attending two conferences, SXSW (pronounced South by South West) and SXSW EDU, in Austin, Texas. SXSW originated as a music conference and festival. It has now expanded to include film, interactive, new technology, startups, coding and more. Its partner conference, SXSW EDU, is focused on education.

While in Austin, I visited the University of Texas at Austin (UT) and toured its makerspaces, as well as spoke to faculty and staff members about their design thinking approach.I then travelled to Atlanta, Georgia, visiting Georgia Institute of Technology (Georgia Tech) to discuss its makerspaces, startup programs, design thinking and programs for developing creativity and innovation through art. I also attended a session with the group STE(A)M Truck, who run workshops with school children utilising mobile makerspaces.

The last stop on my study tour was Palo Alto, California, where I attended an introductory design thinking workshop at Stanford University’s d.school and visited the Nueva School, a progressive school for gifted learners, which incorporates design thinking into its entire curriculum. I also made a visit to Autodesk Pier 9, an innovative makerspace which runs residencies for artists, academics and innovators.

# Significant Learning

## Creativity

Creative problem solving is critical to students’ future as it is a skill that can’t be replaced by automation, however it is not emphasised enough in educational institutions today. In a study conducted by Adobe (Adobe, 2018) presented at SXSW, the majority of educators believe we need to find ways to better integrate and nurture creative problem solving in the classroom. The role of the teacher needs to shift from dispensing knowledge to posing challenges that let students discover new solutions. We need to teach students how to think, learn and apply what they have learned. Teaching strategies that could be used to nurture creative problem-solving skills include active learning, personalised learning, project-based learning and cognitive activation.

Another session I attended at SXSW was called ‘Rigorous Whimsy’, facilitated by Amy Burvall and Dan Ryder. They believe that students should be able to complete activities or assessments using any medium, such as video or painting, as long as the content is still clear. You are not assessing the creativity, you are assessing the depth of student understanding. The point is to ‘use creativity as a tool for students to demonstrate what they know’ (Burvall & Ryder, 2017, p. 99).

Burvall and Ryder believe that when students use creative expression, such as making a poster or taking a photograph, to demonstrate their understanding of content, they are showing critical creativity. The learning becomes more meaningful and ‘sticky’ (Burvall & Ryder, 2017, p. 54) when they can make connections and explain their creative reasoning.

Georgia Tech also recognises that innovation and creativity should be developed in students. They are attempting to do this through their Activate, Engage, Produce project. This includes enriching campus life through public art, infusing creative practice into the curriculum, and encouraging students, faculty and artists to collaborate in making art and producing creative projects.

Creativity is not the same as having a talent or being artistic (like being able to run fast or sing well), it is a way of thinking and being. Creativity can and should be cultivated. By encouraging the growth of creativity in TAFE NSW students, we can help them to become innovative and in demand by employers.

## Design thinking

I became acquainted with many people who spoke about design thinking and how they are using it in education and business. I also attended an introductory design thinking workshop at the d.school to learn about the process. Design thinking is a method for creative problem solving with an emphasis on the human element. Although it has been in existence since the 1950s, it has been more recently popularised by David Kelley, founder of global design and innovation company IDEO and the d.school. In general, the main principles are: gaining empathy for your client; defining their problems; generating a lot of ideas for solutions; rapidly building prototypes; and testing the solution. Multiple rounds of ideation and prototyping are performed as necessary to make improvements.

Elon University is experimenting with a project run over a whole semester, which combines multiple subjects. Using design thinking, the students are collaborating with the local community to build relationships, creating such things as community art. They experience teamwork, creative thinking, communication, research, problem solving and social responsibility. The project gave them real-world skills and they learned that failure is data for the next iteration. Their [Design Thinking Studio in Social Innovation](https://blogs.elon.edu/innovationstudio/) is run like a startup where the students practise the sort of skills that employers value the most, including problem solving, leadership and grit.

Doreen Lorenzo from UT discussed why it is incorporating design thinking into its courses; businesses want employees who have the ability to understand and collaborate with people. It is no longer enough to just gain a qualification – employers want more from their employees. Lorenzo made changes at UT incorporating design thinking so that students could collaborate to problem solve on real workplace issues, as well as learn empathy. UT believes in a wholistic approach to learning so that the students will have a more rounded view and multi-disciplinary experience.

The Department of Theatre and Dance at UT planned a theatre production of ‘Enron’ that required specialist costumes to be made – raptor outfits to be worn by dancers. This provided an opportunity for a project incorporating design thinking, collaboration and practical skills, with the goal to create collaborative, nimble students who can fail quickly then recover. The project had a startup atmosphere and was largely student-led. They wanted the students to be employable and the skills that they have used in this project are very transferable to other industries. I can see this type of project having a major impact on students at TAFE NSW and contributing to their creative problem-solving skills and employability.

I also spoke to Wayne Li at Georgia Tech who, having previously worked at the d.school, is a strong proponent of design thinking. He is trying to recreate the same idea at Georgia Tech, having started the Innovation and Design Collaborative, or [Design Bloc](http://designcollaborative.gatech.edu/), which runs multi-disciplinary classes centred around design thinking. The things that will make students productive employees in the future, such as creativity and empathy, are things that aren’t held by one discipline, so the Design Bloc tries to fill in these spaces. They couldn’t change the entire university so they looked at what was missing and where they could make a difference. Li insists that design thinking can be applied to any topic and that you don’t need to change your content, just the way that it is delivered. Further investigation would be needed, however it is an idea that could be incorporated into TAFE NSW courses.

The Nueva School is a progressive institution that embraced design thinking in its curriculum approximately 15 years ago. They also use project-based and personalised learning, and students work on social problems throughout the semester using the design thinking process. They still cover the required curriculum content by clustering the common core standards and designing integrated projects around them. They are trying to replace ‘What is the right answer?’ with ‘What is the pathway to get the answer?’. They realised that professional fields are changing – people need to be dynamic, flexible, collaborative problem solvers, which is how they are encouraging their students to work. At TAFE NSW the easy path is to deliver and assess units of competency individually. However, clustering common sections will enable more integrated, project-based learning, leading to creative problem solving and so should be encouraged.

## Startups

At SXSW I attended a number of seminars on startups. Both companies (developing external and internal startups) and educational institutions (developing startup programs for students) are reasoning that this is a way to promote innovation and creativity.

[FIAP](https://www.fiap.com.br/), a university in Brazil and a centre of excellence in technology, is one that stood out. Approximately ten years ago they realised that some of their courses were very theoretical and not practical enough, and that young people needed to be equipped with a new set of skills. They decided to focus on experience-based learning and entrepreneurial projects instead of teacher-centred education. Initially, they found it hard to change the teachers’ traditional way of teaching. They ran workshops with the teachers to teach them the same skills as the students.

Its Startup One program enables final year students to create a startup project as their final work, culminating in an awards event. Over one semester, the students define their project, learn agile development methodologies, create prototypes and pitch to investors. The university delivers online lessons as well as periodic class sessions, focuses on mentoring, uses its makerspaces to nurture prototyping and increases interaction with experts.

Another higher education startup program is the [VentureLab](https://venturelab.gatech.edu/), based at Georgia Tech. The VentureLab has two main thrusts: helping students, faculty and staff start up and spin out companies; and entrepreneurial education. They want undergraduates to be entrepreneurial and the [Create X program](http://create-x.gatech.edu/) exists to inspire entrepreneurial thinking. They try to expose students to an entrepreneurial mindset early on.

Startup classes include Startup Lab, Idea 2 Prototype (I2P) and Startup Launch. In Startup Lab they form teams of four or five students to do a needs analysis for a startup. They learn about listening to clients, cognitive biases and running a business. I2P is about prototyping, including using makerspaces. Startup Launch is the final class run over the summer period where the teams present a final project and make a launchable company. Funding is provided by an external investment fund. To gain access to this class the students have to interview and pitch their project.

Following the success of these examples, I believe that implementing a startup program in TAFE NSW and combining it with design thinking could contribute to innovative and creative students.

## Hackathons

At SXSW I attended a session on student hackathons presented by representatives from Major League Hacking (an organisation that runs student hackathons in Europe and the USA) and Capital One (a finance company, which also runs hackathons). They talked about the student hacker revolution and that many thousands of students were giving up their weekends to do hackathons because it was something they were passionate about. Teams ‘hack’ all weekend and all teams demonstrate their projects at the end.

A hackathon can be called an ‘invention marathon’ (Major League Hacking, 2018) and a hacker is someone who solves problems in a clever way by coding. People who attend hackathons are from different backgrounds and don’t necessarily have technical skills – anyone can be a hacker, they just need an interest in technology. Most students who attend hackathons say that they are getting skills they are not learning in the classroom and they are learning by doing.

Jason Valentino from Capital One noticed that when graduates were hired, they loved playing with technology and kept going back to their university campus to mentor at hackathons. This gave them the idea to invest in hackathons and hold internal hackathons with their staff members. They liked the idea of getting people with passion working at their company.

For organisations that hold or sponsor hackathons, benefits include: finding new staff members; helping the fastest growing young leaders; and increasing the organisation’s visibility. Hackathons could be used to help both TAFE NSW students and staff members learn teamwork, collaboration and communication skills, empathy and passion, as well as encouraging them to update or learn new technical skills.

## Makerspaces

Makerspaces are workshop environments, usually located in educational institutions or in the community, where people can create prototypes or products. They may have equipment like 3D printers, laser cutters, sewing machines, and even Raspberry Pis and Arduinos (programmable electronics platforms). Makerspaces encourage creative problem solving, peer learning and collaboration – rather than working on computers by themselves, students create in the makerspace.

I visited several makerspaces including the Foundry and the Digital Fabrication Lab (Fab Lab) at UT, the IDEA Lab and the Invention Studio at Georgia Tech, the Invention Studio at the Neuva School and Autodesk Pier 9. Some of these spaces are free and open to all students and staff members and some are only for use by specific departments or people. The universities have found that having the equipment available to use allows students to experiment and be creative.

At SXSW EDU, I also learned about makerspaces set up in community hubs, which each support between five and ten schools. This can be compared to the way that TAFE NSW’s new Connected Learning Centres function. These regional centres offer interactive technologies to support students who don’t live near a TAFE NSW campus.

At Georgia Tech, the IDEA Lab can be booked for classes, which are split between rooms where they can use the lathe and milling machine, or program computer chips. In the Invention Studio, volunteer students can choose to become masters on specific machines, putting specialist knowledge on their resume. The Studio decided to use volunteers because they wanted passionate, motivated people – they now have hundreds of willing volunteers.

I also attended a session with STE(A)M Truck, an organisation that runs mobile makerspaces for school children, an ‘innovation lab on wheels’ (STE(A)M Truck, 2018). They have recognised the importance and impact on creativity of children by being able to make things, use tools and get their hands dirty. They believe that this kind of ‘tinkering’ can increase access to STEM careers and build other necessary skills such as teamwork, problem solving and communication.

While there are already classrooms at TAFE NSW where students have access to specific equipment and technology required for their courses, the benefits of makerspaces include access outside of class time and across disciplines. However, it may be more difficult to set up a volunteer student system similar to those I observed, as students generally attend TAFE for a shorter length of time.

# Conclusion

The workforce of the future will require a heightened sense of creativity and empathy, as the job market is increasingly requiring broader, less targeted skillsets. There will be a strong need for those who can collaborate and generate creative solutions.

TAFE NSW has the opportunity to empower students to become thought leaders by ensuring creative problem solving is cultivated and encouraged, enabling collaborative and entrepreunerial learning. This can be encouraged by using methodologies such as design thinking, startups, hackathons and makerspaces. By partnering with businesses, they can also provide real-life problems for students to work on.

From the examples I have seen during this study tour, design thinking fits well with a startup environment where students work on real-world problems. Working on projects in teams using these methodologies has the potential to enhance the students’ skills in collaboration, communication and creative problem solving. Learning these skills at TAFE NSW would go a long way to ensuring they are the kind of employees that are in demand.

Hackathons are another way of improving the same skills, although it may be harder to enourage some people (both students and staff) to join in voluntarily at first. It is important to support those who are new to hacking using such things as coding workshops, tutorials and mentors. The hackthons should be promoted as opportunites for having fun, as well as networking and learning.

Some of these techniques could be implemented at an introductory level, for example Certificate III, to get students used to these ideas early. This could culminate at the Diploma level in a major group project run in a similar way to a startup.

Teachers would need to be supported to be able to run these classes by facilitating workshops and providing scaffolding. Starting small (such as with one class) with willing and passionate teachers, would be of more benefit than trying to overhaul all classes at once and meeting resistance. When people see success happening, they become more interested. It is also important to empower teachers and involve their expertise rather than enforcing from above.

By examining the methodologies encountered during this study tour, we can push ourselves to foster creative problem solving and ensure an adaptable, desirable workforce for the future.

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# References

Adobe, 2018. *Creative problem solving.* [Online]
Available at: http://cps.adobeeducate.com/
[Accessed 7 March 2018].

Bloomberg, 2016. *The Bloomberg Job Skills Report 2016.* [Online]
Available at: https://www.bloomberg.com/graphics/2016-job-skills-report/
[Accessed 30 June 2018].

Burvall, A. & Ryder, D., 2017. *Intention: Critical creativity in the classroom.* 1st ed. Irvine, CA: EdTechTeam Press.

Major League Hacking, 2018. *Frequently asked questions.* [Online]
Available at: https://mlh.io/faq
[Accessed 26 August 2018].

STE(A)M Truck, 2018. *What is STE(A)M Truck?.* [Online]
Available at: https://www.steamtruck.org/#Whatissteamtruck
[Accessed 28 July 2018].