



Professional Learning
Research
Innovation

Learning in Practice

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About the Barker Institute:

- Provides a centre for research, reflective practice, professional learning and innovation in education
- Is a resource hub that facilitates the ongoing development of learning for teachers, allowing them to stay abreast of emerging practice, constantly striving to refine the quality of teaching and learning
- Looks to develop collaborative ventures with other institutions and providers, initiating research and innovation combined with the implementation of new projects and programs for the benefit of students, staff and the broader community
- Shares current research and issues with parents, professional bodies and educators around the globe through ongoing symposia, forums, lectures and conferences

About the Learning in Practice Journal:

As a leader in Christian education, Barker College aims to both demonstrate and inform best practice. This journal was developed to showcase a range of initiatives and research projects from across the School. It explains the rationale behind innovations in practice and archives pivotal developments in Barker's academic, co-curricular and pastoral realms.

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Nonie Taylor is an Earth and Environmental Science, Mathematics, and iSTEM teacher. Prior to teaching, she worked for fourteen years as an advanced wastewater engineer for a water utility company. During this time she was concerned by both the absence of female representation in the water industry as well as the shortage of creative, passionate young engineers to pursue education. She presented at OzWater 2016 on the importance of STEM education to the water industry and she is on the Water Educators' Network Committee for the Australian Water Association.

Nonie Taylor

Science and Mathematics Teacher

Abstract

In this article I am going to address three questions:

- What is STEM Education?
- What has STEM got to do with the water industry?
- How can STEM education be done well?

When I was at school I wanted to make a difference with my life. I hated the idea that there were people in the world who did not have access to clean drinking water and sanitation, and that is what drew me to engineering and the water industry. After university, I spent 13 years in the water industry, working for a major water utility in Sydney. I enjoyed my work. I knew every day that I was making a difference. However, a couple of things became increasingly apparent to me: we need good people to solve the problems we will face. People with passion for what they do, and an ability to sink their teeth into difficult problems and come up with new solutions. This need sent me back to university, and into high school education, with the desire to 'win' more people over to the STEM subjects – Science, Technology, Engineering and Mathematics.

So what is STEM Education?

STEM is an acronym that stands for Science, Technology, Engineering and Mathematics. In today's society, STEM is all around us – the way our food is produced, the way we connect with our friends and families, our health, our jobs, our leisure are all “profoundly shaped by technological innovation and the discoveries of science” (Australian Office of the Chief Scientist). In addition, 75 % of the fastest growing occupations require STEM skills and knowledge (Australian Office of the Chief Scientist). So as a nation, we need our school graduates to have a greater understanding of STEM subjects if they are going to be prepared for the future ahead.

Sadly, however, there has been a decline in students choosing STEM subjects in school, so as a nation we are not equipping ourselves with the skillset we need to carry Australia into the future (see Figure 1: Year 12 Students studying STEM 1992 & 2010) .

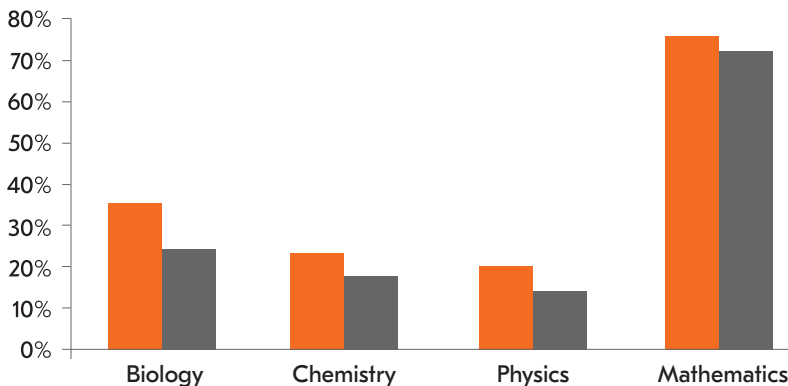
Figure 1: Year 12 Students studying STEM 1992 & 2010

The Government has identified this as a major issue for the future of Australia, and has committed money (over \$17 million) through a variety of initiatives to restore the focus on and increase the update of STEM subjects in primary and secondary schools. Why? To equip young adults with the necessary skills for the economy of the future.

Year 12 students studying STEM

Proportion of Year 12 students (%)

1992 2010



Source: Senate Standing Committees on Education, Employment and Workplace Relations. Inquiry into the shortage of engineering and related employment skills, 2012

What has STEM education got to do with the water industry?

STEM Education is important to our nation as a whole, but now let's think about STEM in the context of the water industry.

There are a number of challenges that have been identified as specific to the water industry. Limited resources, environmental pressures and population growth mean we will need a workforce who are more innovative, and willing to try new ideas. Increased automation of the water industry means we will need a workforce who are increasingly technical. Finally, the issues with attraction and retention of employees to more lucrative industries (such as mining), and loss of 'inhouse' knowledge as a result of the aging workforce means that the water industry needs to be able to attract and keep the right people with the right skillset (Australian Water Association, 2012; Department of the Environment, 2009).

We are facing a skills shortage in STEM subjects at the same time as there is more pressure on us to do more with less, to be more innovative, with less impact on the environment, and with new technologies.

We also need to have an industry that attracts the right people – we need great minds, great communicators, great decision makers and great interpersonal skills. We need to give opportunities for people to see what the water industry does and why it is an exciting place to work.

We also need to be able to communicate the issues the water industry faces with the public in a way which is relevant to and makes sense to them. For these reasons, STEM education is critical to the future of our industry.



How can STEM Education be done well?

There are some general strategies which have been demonstrated to increase students' engagement with STEM subjects. They include:

- *Engagement from a young age* – it is often too late in high school to start getting students interested in STEM subjects. I'm amazed at how many Year 7 students have already decided that Science is too hard and that they don't like it.
- *Integration across the curriculum* – where STEM education does not just happen in the Science/Technology/Engineering or Mathematics classrooms – it is incorporated throughout school curriculum.
- *Project Based Learning* – rather than subjects being taught separately, students learn through solving a problem that spans across subject areas.
 - For example, at Barker College students engage in a CO₂ dragster project where they use IT software to visualise their projects, Mathematics for graphing and calculating speed, Science to understand the forces involved and benefits of streamlining, Design and Technology to design and construct their project, and English to write their instructions. Students are supported by teachers from the various subject areas, but learn to see the separate subjects as interlinked to achieve the final product.
 - Another example is the Hotbox Composting project where students design a box for composting which they then need to market. This project incorporates the programming of controls to monitor temperature, moisture content and ventilation, uses the students' knowledge gained from Agriculture, and also Economics and Commercial Studies to plan their marketing.
- *Connections with Industry* – a great strategy for STEM education, and particularly one which would be a great opportunity for the water industry, is to give students the opportunity to work with 'real-world' STEM professionals.
 - An example could be through working with local council to investigate a local waterway together. The Water Educators Network has put together some resources for investigating local waterways that councils or other water industry partners could utilise with schools.



- At Barker College, the Sydney University Marine Research Station at Lizard Island partners with Year 11 Biology students to contribute to the long term survey programs. Students get to see scientists in action, and the research station benefits through the assistance provided by the students.
- CSIRO runs a 'Scientists in Schools' program where STEM professionals can visit schools and share their experience.

Conclusion

STEM education is critical to the future of our nation, and more specifically to the water industry. Organisations need to consider the role that they are playing in supplying the future with enthusiastic, passionate, water industry professionals who have the right set of skills to face the challenges of the future. We need to ask 'what kind of water professionals do we want for the future?', and 'what role can I play in finding them?'

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