

## STEM at BHS

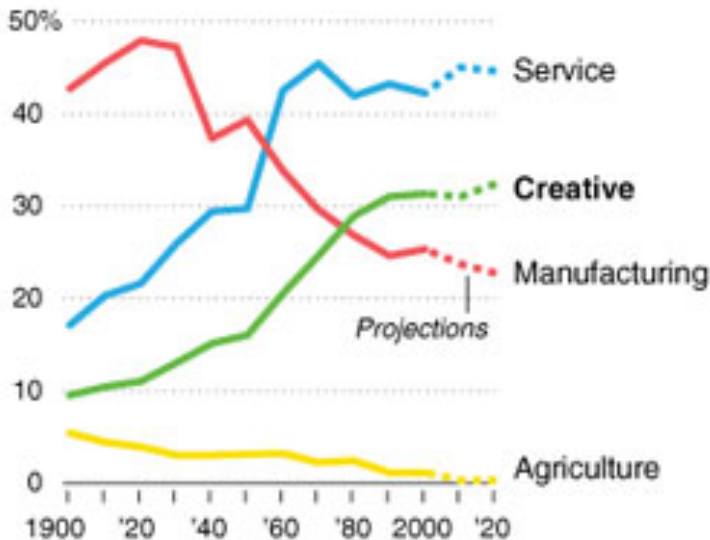
I'll start this blog entry by sharing some very interesting statistics.

Currently Australia's youth unemployment is at 27.2% (which is 4.5 times the general unemployment rate). In some countries -eg Greece and Spain- it has now reached 50%.

By 2020 (when our current Year 8s are graduating from high school) 50% of all new jobs in Australia will be freelance that will mostly be bid for in a highly competitive on-line marketplace.

By 2030 (when our current kindergarteners are graduating from high school) 47% of all current jobs will be automated.

**Percentage of workforce, by decade**



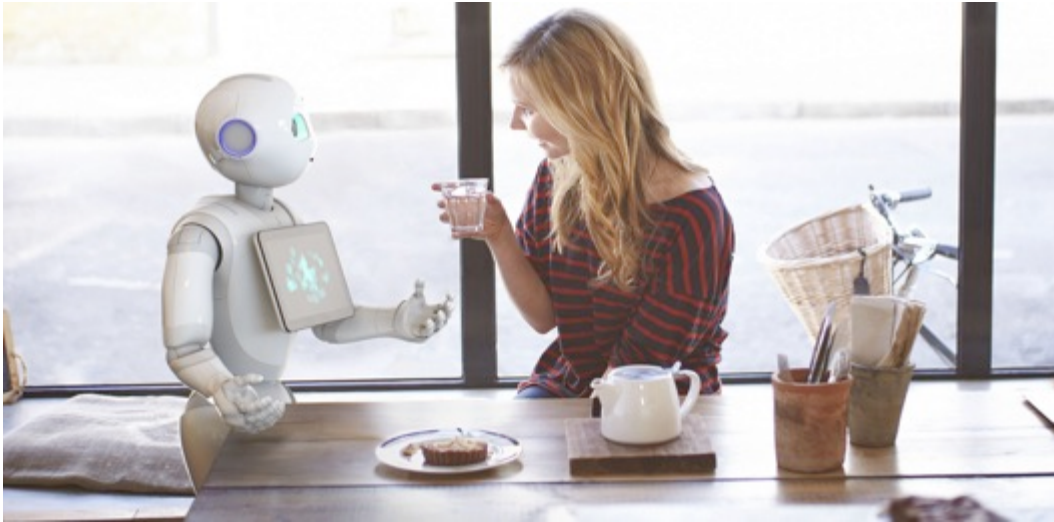
As you can see from the graph above, automation has already had a huge impact on the manufacturing sector, with a sharp decline in available jobs. If we look at these examples below, my guess is that the service industry will be next, resulting in the 'creative' sector being where most job growth will be occurring into the future. Note: these examples are not science fiction, these are already a reality.



Above: This two-story hotel, which has recently opened in Japan, features robot staff as well as rooms which use face recognition in place of keys.

Hideo Sawada, the company's president, said that they will make it the most efficient hotel in the world. Room cleaning, porter service, front desk, and other services are being performed by these robots.

Below: Equipped with an array of audio, visual and tactile sensors, Pepper is the world's first personal robot that can read people's emotions, it uses voice-recognition technology and proprietary algorithms to analyse people's feelings from their facial expressions and tone of voice.



Created for SoftBank Mobile—one of the largest mobile phone operators in Japan- Pepper is already greeting and interacting with customers in stores. He is currently fluent in 19 languages with more to be added.

Below: Pepper will begin offering concierge service at Mizuho Bank, one on Japan's major banks, in July, 2015. He will be fitted with a special app specifically suited to Mizuho Bank. He will greet customers, introduce them to relevant services at the bank and entertain customers while they are waiting.



But it will surely be far too expensive to become widespread? Well no, Pepper only costs around \$1,900US with an on-going contract for software updates etc, similar to a monthly mobile phone plan.

Below: This cafe in Ningbo, a seaport city in northeastern China's Zhejiang province now has automated waiters who take orders and serve food to any table within the restaurant - and tell customers to enjoy their meal in Mandarin. The machines navigate their way around with the use of an optical sensing system.



Below: And teachers are not exempt.



NAO is a fascinating teaching tool thanks to its interactive applications and intuitive interface. It captures the attention of children and promotes individual and group work. Children discover technology and enjoy learning. And, of course, you can also talk about geography, mathematics, basic concepts, and much more with NAO.

By 2050, (when our current high school students will be in their late 40s and early 50s) it is imperative that they will have successfully worked collaboratively with teams of people from across the world to solve some extremely complex problems. Eg If global temperatures do not start coming down by 2050 then the damage caused will be irreversible and if they can't do something about the rate our world population is increasing or do something to improve resource management, then by 2050, our planet will not contain enough food, water and other resources to sustain this population.

So, all this leaves us as a school in a very tricky situation, having to make a very difficult decision. It's what David Price OBE describes as the choice between 'doing what's right vs doing what's required'.

Doing the right thing would result in us fully preparing our students for the world in which they will work and live (which will be very different to the past) by providing them with an 'education worth having'.

Doing the required thing would be to focus on 'going back to basics', to deliver an out-dated, content-driven curriculum and improving scores in standardised tests; hence giving them an education that beautifully prepares them for a world that no longer exists.

I would like to link this dilemma to the current, significant push to increase STEM in schools; ie promoting greater student involvement and successful achievement in Science, Technology, Engineering and Mathematics. Personally, I think this is a fine thing, however my immediate thoughts are, given the information in the first half of this blog:- "What should STEM look like in the 21<sup>st</sup> Century, ie what is a STEM education that is worth having?"; because most of what I have recently seen and read is still focussed on last century thinking.

The Learning Frontiers project that we have been involved with for the last 18months has four Design Principles that have been proven to have a significant impact in raising 'intellectual engagement' and hence success at improving student outcomes. I thought it would be useful to consider what 21<sup>st</sup> Century STEM might look like through the lens of these four design Principles (Integration, Connectedness, Personalisation and Co-creation).

<b>Design Principle</b>	<b>Last Century STEM</b>	<b>21<sup>st</sup> Century STEM</b>
Integration	Science, Technology, Engineering and Mathematics taught as separate subjects where students struggle to see the links between them.	Integrated units of work are created which require students to simultaneously use strategies and knowledge from all four disciplines at once. Some innovative educators are also integrating the Arts across these units creating a 'STEAM' approach.
Connectedness	Each subject taught in isolation where students are asked to complete 'fake' problems written in a textbook with little or no connection to the real world.	Using a problem based approach where the learning is connected to both the real world and students' own experiences increases the value and relevance of the learning.
Personalisation	A one size fits all approach in each subject, where all students are studying the same thing, at the same time from the same person in the same way, even though we know every student is unique.	Differentiation is commonplace and students are given opportunity to have 'voice and choice' throughout the STEM based units of work.
Co-creation	Teachers working in isolation develop their own curriculum, tasks and assessments in their own specific subjects.	Educators collaborating in teams and co-designing and co-constructing the curriculum, learning tasks and assessment activities with students, parents, community members and industry experts.

This view is supported by other forward thinkers in this area:-

“STEM education isn’t just one thing – it’s a range of strategies that help students apply concepts and skills from different disciplines to solve meaningful problems.” 2014, Jo Anne Vasquez

“STEM education is an approach to learning that removes the traditional barriers separating the four disciplines and integrates them into real-world, rigorous, relevant learning experiences for students.”, 2013, Sneider and Comer.

“Trans-disciplinary integration, grounded in constructivist theory has been shown to improve students’ achievement in higher-level cognitive tasks through the application of scientific processes and mathematical problem solving.”, 2002, Satchwell and Loepf.

So, when we consider what strengthening STEM education looks like at Birdwood High School, I think it is vital that we do so through in a way that embraces a 21<sup>st</sup> Century approach. Hence here are my initial thoughts:-

**Senior School:** Whilst we run fantastic programs in all of the traditional Science and Mathematics subjects and have industry standard Vocational courses in Technology and Engineering, we could investigate an integrated subject that meets the SACE requirements but allows students to collaborate in teams to solve authentic complex problems of interest to them, requiring skills and knowledge from each of the four (or five) STE(A)M disciplines. This process would also see students practicing the Engineering design process (defining the problem; developing a solution; agreeing on a blueprint; optimising their design; justifying it’s merit; building the product and finally reviewing the success or otherwise). There is currently industry interest in such a program and a small number of innovative schools both locally and globally are trialling this as an approach, so there could be an opportunity to collaborate with them.



**Years 8 – 10:** Our existing ‘Academy of Innovative Learning’ (AIL) structure is perfect for 21<sup>st</sup> Century STEAM. We already have integrated units of work with authentic driving questions linked to real world problems and genuine student ‘voice and choice’ built into them. However, I feel there is a chance to make STE(A)M at school look more like it does in the (21<sup>st</sup> Century) real world, and there is a fantastic opportunity for our students to co-design what that would look like. One of the best ways to achieve this is through an ‘innovation lab’ (or commonly called a maker space). The maker space should be a place where students can tinker, create, be inspired and get excited about STEAM.

As well as a design thinking space, it should include the more technical aspects of making including 3D printing, robotics, coding, using sensors to interact with the world around them, but equally more traditional maker activities including woodworking, growing food, textiles and a range of arts and crafts. I would also like for interested students (in second semester 2015) to co-create the space, co-design the open-ended, integrated units of work, co-create the management structure for the maker space and trial the use of a variety of tools that have recently become accessible to schools due to their affordability. This would lead to the centre being fully functional by the start of 2016. A logical extension to this would be how we could offer the space so that Primary School and Pre-school children in our Partnership could take advantage of the centre.

Here are just two examples of the sorts of products I envisage our students could be designing, refining and producing in this type of environment.

1) Fashion technology; LilyPad is a set of sewable electronic pieces designed to help you create interactive garments. The one on the right is a 'turn signal' bike jacket to improve safety for cyclists. Other applications could be to use conductive thread and UV sensors sewn into garments to detect exposure to sunlight or CO<sub>2</sub> sensors or devices to capture movement, eg sensors on ballet shoes to record dance steps.

2) I recently heard of a young woman who was working on a tool for a friend who was diagnosed with autism: she had designed a pendant with an inbuilt sensor that would discreetly vibrate to tell her that she was invading someone's body space.

What we would be attempting to do with this integrated, open-ended, project based approach, is have our students improve their skills in Mathematics and Science through creating devices of value to others, rather than completing low level activities, like printing a cover for their iPhone.



I would like to gain responses from a range of students, staff, parent, community members and industry experts to this proposal, so I have set up a space for you to share your thoughts.

Log on to <http://todaysmeet.com/bhssteam>

Then in the 'blue box' type in your name and click 'join'.

Next type your response in the 'message box'. You are allowed up-to 140 characters. (If you go over that, you will not be able to post your response. The gray number on the above right of this message box tells you how many characters you have left – if it is a negative number, you have gone over the limit.)

Once you have typed your response, click on 'Say' and your comments will be added to the list in the 'Listen Box'.

You are also able to scroll through the listen box to look at other people's responses.

The website will close on the 9<sup>th</sup> of July, 2015.

Thanks in anticipation, for your contribution to this really exciting initiative, cheers Steve.