Australian Government

Chief Scientist

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In2Science STEM Partnerships Forum

Opening address

STEM careers: a broad horizon

22nd May 2019

Engineers Australia
MELBOURNE

Most of the time when I go out into the community to talk about science, people are very supportive.

But occasionally, I'll get to the end of my speech, someone will put up a hand, and they'll ask me a variation of a question I've heard many times.

"Alan, aren't you afraid that we're overselling STEM?"

Sometimes, of course, they don't wait to ask me.

They make the assertion that we're overselling STEM. They tend to say it to journalists, who print it in newspapers, under headlines like: "Not enough jobs for science graduates challenges STEM hype".

That was the Sydney Morning Herald last month.

But every Chief Scientist will tell you it's been a constant theme.

As it happens, speaking for myself, I have not been out there beating the drum, insisting that we abolish arts and economics and shovel all the kids into STEM.

Now if you get past the hype, the point that about insufficient jobs isn't wrong. In fact, it's obvious. The number of people who actually work in a laboratory, as a research scientist, in Australia, is very small.

We're looking at fewer than 30,000 people, in a workforce of 13 million.

The number of people who work in one of the 108 occupations that the Department of Jobs classifies as a 'STEM job' is much larger – in the order of 2 to 3 million.

But still, the fact remains, there are people with STEM qualifications who aren't doing one of those so-called STEM jobs.

So it follows: telling hundreds of thousands of young people to study science because they can all be scientists is deeply misguided.

We can all agree.

But I'm still going to go out into the community and encourage parents, schools and students to prioritise the core subjects of science and maths.

I'm still going to say that it's a problem that performance and participation in these subjects has been slipping in our schools for at least two decades.

And I'm still going to tell young people that if science excites them, and they've got the commitment to jump in and dive deep, then that's what they ought to do.

And I'll do that not because I or anyone else can guarantee them a so-called STEM job – but because I want them to thrive in a world where there are no guarantees.

I want them to have a skillset that gives them options – and opportunities.

But let's go back a few steps... and let me introduce you to a person who, on some definitions, is a failure.

Me.

As a teenager, I was your typical 1960s high-school nerd.

I loved the gleam on that green laminate lab-bench... and the smell of the gas from the Bunsen burner.

But I didn't have any fixed ideas about a career.

I panicked about not having a lifetime plan for a while, then I opted for engineering.

At the end of my degree, the obvious next step was to qualify as a professional engineer.

I didn't. I took a detour from the 'E' in STEM to the 'S', and started a PhD. In neuroscience. More specifically, the electrical activity in the brains of snails.

Whatever I thought I'd be doing at the end of high school, it wasn't sticking electrodes into gastropods.

Anyway, I did that for a few years, finished my PhD, and started my post-doc.

By that time, I'd become intrigued by the wiring of the brain – so similar and yet so different from man-made electrical circuits.

But most of all, I loved tinkering with the lab equipment. It was so much more exciting than doing the experiments!

I came up with a design for a sophisticated electronics amplifier called a single-electrode voltage clamp. Other scientists who came to our lab wanted to buy them.

So I decided to sell them.

I packed my bags and headed to Silicon Valley, set up a company called Axon Instruments, and went into business as a device-maker for medical science and medicine.

To recap: I'm now in my early thirties, I've swapped the E for an S, I've dropped the S, and I'm onto B: business.

The pivot to B turned out extremely well – so well that I was employing over 100 people.

Eventually I tried to retire, but it was awful, so I quit.

I became a C for university chancellor, a W for writer and a P for public servant.

And in all that time, I've never built a single bridge.

So I can only guess that on some people's definitions, I've been wasting my engineering degree for a very long time. A failure.

I've got two sons. They also studied engineering. One of them, Alex, became an engineer – an extremely good one. The other, Victor, failed even faster and harder than I did. He became... a McKinsey consultant!

Let's have a show of hands. Who's a failure? Who's working today in a job that's not a one-to-one match with their first degree?

Who works in a business that's run by a failure?

Who's married to a failure?

Who encouraged their kids to become failures?

Failure is normal! Many of us would say that failure is great!

Because the reality is, you may never work a day in your life in a particular profession, and still be getting value from your degree.

What I got from engineering was a set of cognitive tools: ways of breaking down a problem, of thinking about risk, and of managing a project.

I learned that engineering is the art of optimisation, when perfection isn't affordable and compromise isn't an option.

I apply these tools even when I'm not conscious that I'm doing it.

My wife and my staff will tell you that my default setting is "engineer".

In fact – and I love this – they call me “the incurable engineer”.

And along with those tools, engineering also gave me the philosophy that drives me to this day: you never give up, you always keep striving, because you know from experience that there’s always a better way.

I’m not the only one who’s seen the value of these attributes in leadership.

They say that a Masters of Engineering is the twenty-first century MBA.

And clearly, having an engineering background has turned out pretty well for the likes of Jeff Bezos, Angela Merkel and Xi Jinping.

Now in praising engineering, I’m not seeking to attract every high school student into an engineering degree, nor am I seeking to put down other disciplines.

Any well-taught discipline can give you a set of useful and transferrable tools. Law. History. Economics. Science.

My advice to students is to make sure you’ve got the foundations – English and maths – because whatever you do, you’re going to need them.

Then work out what you enjoy, and what you’re good at – and immerse yourself in it. Master your chosen discipline. Get that firm grip on the tools. And be open to where your interests and skills might lead.

You’ll spot that door to opportunity.

And when you see it, you’ll be ready to push it open.

Are students capable of facing the idea that a study path can be valuable even if it’s not a beeline to a specific professional job?

Yes – because they’ve done it forever in economics.

Of all the people with economics qualifications, guess how many work as economists?

3%.

How about law graduates?

There are about 120,000 people in the country with law degrees.

About 60,000 work as legal professionals.

But we're now producing new law graduates at a rate of 15,000 every year: that is, enough to completely replace the existing workforce in just four years' time.

So either lawyers burn out extremely fast, or a lot of law grads are doing something else.

We respect our students enough to believe them capable of choosing economics and law with their horizons open.

So, too, we should respect our students' choice of a STEM degree with their career horizons open.

That's not just on parents and teachers – that's on all of us.

We often speak about education as a three part continuum: primary, secondary, tertiary.

In reality, it's a four part continuum – because the learning continues into work.

Employers care about what their future workers are taught in schools and tertiary institutions.

Schools care about what their students need to know to get into the tertiary degree of their choice and gain employment.

So the signals up and down the continuum are important – and so are the relationships.

That was the genesis of the STEM Partnerships report I prepared at the request of the COAG Education Council in 2018.

In writing that report, I was impressed by two things.

One, the high degree of unanimity about the problems in STEM education between teachers, university lecturers and employers.

And two, the fact that when we got all of these people in the same room, together, they were often surprised by how much they agreed.

That was a symptom of the problem that everyone acknowledged: we're not good at working across the continuum.

In our report, we focused in particular on the break in the continuum between high school and university.

It used to be that university degrees would have entry prerequisites: subjects you had to study in order to get in.

That would send a very clear signal to high schools about what they had to teach.

Now most of those pre-requisites are gone.

I mean it: there are universities in this country that will accept you into an engineering degree even if you went through Year 11 and 12 without studying maths – any maths, even maths at the most basic level.

You might think that any student who was interested in engineering would work out that maths might be important.

Perhaps – but that same student will definitely work out that he or she will need a high ATAR.

And rightly or wrongly, students are advised that if they opt for basic-level maths instead of calculus-level maths they are more likely to be rewarded with the high ATARs they need for university.

So you can't blame them for trying to maximise their ATARs in order to get into engineering... by dropping the very subject that they actually need to have any hope of doing well in their engineering course.

It's not just maths, and it's not just engineering. Employer after employer drew us back to that problem: talented students, poorly advised, inadequately prepared.

We presented that evidence to COAG, and I've now been asked to report back on steps that we can take to give students what they deserve: informed choice.

But restoring prerequisites is just one facet of restoring the continuum.

We've got to open our students' minds to the possibilities that there are many ways to succeed with a qualification in STEM.

And that's where school and industry partnerships can be invaluable.

We'll dive into that conversation today.

But let me preface it with my list of the key messages that I want all employers to be sharing with students, in all of their dealings with schools.

Message Number One. Whatever you read, whatever you're told, don't drop English and maths. We, employers, need workers who are literate and numerate, whether we're a tech startup or the butcher's shop that I saw this Christmas advertising for workers.

The chalkboard sign in front of the shop window had eight words: Help wanted. English and maths essential. Apply within.

Once more: don't drop English and maths.

Message Number Two. We, employers, don't expect you to come out of university a one-to-one fit for a job. No: we understand that the role of a university is to make you job capable, not job ready.

A graduate who's only trained to do one thing is a graduate we've set up to fail if that one thing doesn't go right – or ceases to be relevant to our firm.

We, employers, look for graduates who've made the most of their education to date, and have the inner momentum to keep that learning going.

In my days as a CEO, we did everything we could to build a culture where pivoting to new areas was encouraged.

We offered a full week, paid, for professional development every year. And we insisted that employees take it.

Not because we were nice, but because we were sensible.

If we're going to create that culture right across the economy, then we need many, many sensible employers – doing it, saying it, and sharing it in schools.

So, employers, step up: recognise your obligations.

Message Number Three. We, employers, don't just use STEM graduates in the obvious ways.

They don't just stand around in white coats in labs or sitting at computers writing code.

No: they design buildings, they write policy, they plan cities, they fly drones, they sit on the company board.

And in all of those jobs, they're using their STEM degrees.

How do we convey that breadth to young people?

My advice: don’t give them a list of job titles.

Let’s be honest, how many people have a job title that describes what they actually do?

How many teenagers find job titles in the least bit exciting?

It’s much better to focus on the real-world problems your STEM-trained people are helping to solve.

That’s interesting. That’s motivating. That puts the focus on how STEM is actually used.

So to recap: we, employers, will go into schools and convey three things.

One, don’t drop English and maths.

Two, your degree isn’t the end of your education, it’s what opens doors, and it signals another start.

And three, STEM education addresses real world problems and is useful to us and the wider community in many, many ways.

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So, failures on the panel, and fellow failures in the audience today, we’ve got important work to be getting on with.

May the Force be with you.