

Australian Government

Chief Scientist

STEM PIPELINE FOR THE DIGITAL HUMANITIES: BUSINESS/ HIGHER EDUCATION ROUNDTABLE

20-MINUTE ADDRESS

A Pipeline Through the Digital Divide

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Swinburne University of Technology

As I was preparing for this session an article posted caught my eye.¹

It was about an online platform called 'Mathletics' that promises to make maths homework enjoyable.

I can only salute such ambition. And it seems to be improving outcomes for many students.

They tell researchers that they are more motivated, more confident and more aware of the importance of the maths in their lives.

But this article was not about all the students learning maths in a fun way. It was about a ten year old boy from Victoria whose mother could not pay for an internet connection.

When **his** school introduced Mathletics he found he couldn't do his homework.

Many young people might see this as serendipitous. This child did not. He was kept back at lunchtime, every day, to catch up. He saw this, with some justification, as undue punishment. It certainly did little to improve his grades.

I am not sure we are raising that child to love mathematics.

But we might be teaching him something about the reality of the so-called Australian 'fair go'.

And so I wonder – what would this boy and his mother think of the digital future we are planning here today?

- Will he want, or be ready, to study science or mathematics at senior level?
- Will he train for a career in a science field?

¹ <u>http://theconversation.com/e-homework-is-widening-the-gap-for-disadvantaged-students-31047</u>.

- Could he function in *any* modern industry without basic maths or computer skills?
- If he can't compete for work, how will he access government services?
- How will he do his banking, or shopping, or pay the bills?
- If he wants to travel, how would he plan it?
- If he wants to know something, where would he look for answers?
- If he's got something to say, where's his platform?

A few years ago, the Harvard Graduate School of Education released a report *Pathways To Prosperity*.

Its opening paragraph says: One of the most fundamental obligations of any society is to prepare its adolescents and young adults to lead productive and prosperous lives as adults. This means preparing all young people with a solid enough foundation of literacy, numeracy, and thinking skills for responsible citizenship, career development, and lifelong learning.

This was not a particularly modern insight. Erasmus said the same thing in the fifteenth century. *The main hope of a nation lies in the proper education of its youth.*

It was never more true than today.

And while it is easy to be excited by the promise of new technologies, we have to temper that excitement with perspective.

We live in a country where:

- More than two in five families in the lowest income bracket make do without the internet at home. That is more than 610,000 families and their children.²
- Less than one in two businesses has a website, and less than one in three is equipped for online sales.³
- Just two in five businesses describe themselves as 'innovators', and 1 in five can point to any new or significantly improved product or service introduced in the last year.⁴
- Our patenting rate is poor, and our record on businessresearch collaboration is among the worst in the OECD.
- The achievement gap in mathematics between our best and worst performing states is equivalent to two years' worth of schooling - how does that fit with the idea of a 'fair go' in a land where we think we are all each other's equal?
- Australian schools show a decline in the rates of participation in 'science' subjects to the lowest level in 20 years.
- Domestic higher education completions for ICT are barely inching forward after dramatic falls about a decade ago.
- Primary subclass 457 visas for ICT Professionals, on the other hand, ballooned by 74 per cent in the two years to 2012.

What does that mean for an economy we like to tell ourselves is in 'transition'?

² ABS (February 2014). 8146.0. Household Use of Information Technology, Australia, 2012-13. ³ ABS (August 2014). 8167.0 - Selected Characteristics of Australian Business, 2012-13 Available: <u>http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8167.0Main%20Features12012-</u> <u>13?opendocument&tabname=Summary&prodno=8167.0&issue=2012-13&num=&view=</u>

⁴ ABS (August 2014). 8158.0 - Innovation in Australian Business, 2012-13 Available: http://www.abs.gov.au/ausstats/abs@.nsf/mf/8158.0

What does it mean for that ten year old boy and his mum and all those like them?

It suggests to me that we might have a problem.

I hasten to add this is not an argument against Mathletics. Nor I am suggesting we can turn back a global tide, and stick to textbooks where others progress to code.

Because we **do** know that nations all around the world are resetting their economies.

We **know** that new technologies are pushing smart companies to the lead.

We know that new skills **are** required for workers at all levels as economies change.

We know that much of modern research is unimaginable without ICT.

And we know that collaboration between science and business, and between business and educators, is critical to the industries of the future.

I am simply putting it to you that we have to think of all these things as the **means** and not the **end**.

The end is a stronger Australia with an economy and a society to match. An Australia in which a ten year boy or girl can be curious about the world, study hard and prosper – any ten-yearold boy or girl, born anywhere into any circumstance.

And if we are serious about it, we will understand that it calls for innovation on a scale we have never achieved – and perhaps never bothered with – in our history.

It calls for patience, persistence, and collaboration. And it needs passion – passion in the educators, passion in the students, passion that we can persistently use to persuade the public just how important this all is.

Because wouldn't Mathletics be much better when the teachers are properly trained and supported?

- If we had at least one teacher, specialising in science, and capable of sharing science as it is practised, in every school?
- If universities encouraged students to take mathematics and science in Years 11 and 12 (rather than, generally speaking, framing the pre-requisites to keep enrolments up)?
- If industry worked with educators to train young people for real world needs?

Then Mathletics would help us to open the skills pipeline – not dictate who gets to pass through.

But why should we stop there?

- Wouldn't the pipeline be easier to build if the business climate was receptive to science and innovation?
- How about if Government used its research and procurement spend to foster a start-up culture?
- What if every part of our research sector could be strengthened by developments in ICT?
- What if every Australian was engaged and inspired about science?

But we **don't** think about the skills pipeline as something we have to work on together – with a push at one end, a pull at the other, and a pathway to connect the two.

We do a lot of good things in isolation.

That's not how we set about the Snowy Mountain Scheme. It's not how we think national security should be managed. It's not the way any intelligent person would set about a bathroom renovation.

We think, we plan, we cohere.

Then we achieve something we can really be proud of.

I have often made the point that Australia is now the only OECD country without a plan setting out its future in science.

So I wrote one – or at least I have put my recommendations for such a Strategy to the Australian Government.

I welcome the support it has received from many sectors, including the ICT sector, including the Australian Information Industry Association.⁵ As Board Member John Grant remarked:

"The level of investment lead economies such as the US, UK, South Korea, Singapore and the European Union are directing to STEM, educational and training, innovation, entrepreneurial capability development and high tech start-ups, is clear evidence that serendipity is not a sure bet."

It is a sound point.

Britain has made coding mandatory for primary school students and teaches computer science to all students from age 5 to 17.⁶

⁵ Australian Information Industry Association Media Release, 4 September. Available <u>https://www.aiia.com.au/news/192132/ICT-Industry-calls-on-Government-to-urgently-implement-Chief-Scientists-STEM-strategy-.htm</u>.

China has prioritised ICT in its Five-Year Plans for decades. The latest iteration designates the ICT industry as one of China's seven strategic and emerging industries.⁷

The European Union has pledged to double public investment in ICT research and development to €11 bn by 2020.⁸

It is not an easy thing to 'punch above your weight' these days - no matter how often we assure ourselves that we do - especially when we don't know what it really means.

Perhaps it is no coincidence that our place in the World Economic Forum's ICT competitiveness rankings has slipped, from a peak of 9th in 2004 to 18th in 2014.

We *are* making progress – but it is slow and incremental in comparison to what others around us achieve.

I think we can learn something from those countries. I don't mind saying I've copied some of their ideas.

There are a lot of bits to my recommendations. They operate across four fields for action: **competitiveness**, or innovation; **education**; **research** and **international engagement**.

My message to you today is that the skills pipeline crosses them all – and so we cannot pursue any of the ideas, or the fields, in isolation.

With that said, I am always asked just *how* I propose to go about things.

If there is one particular point that I want to press today, it is that inspired and inspirational teaching is essential.

⁶ http://www.theguardian.com/technology/2014/sep/04/coding-school-computing-children-programming

 ⁷ ITIF (July 2014). ICT Innovation Policy in China: A Review. Available: http://www2.itif.org/2014-china-ict.pdf
⁸ https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/DAE%20SCOREBOARD%202013%20 %20EXECUTIVE%20SUMMARY.pdf.

When teachers have the relevant knowledge about (and passion for) the subject that they're teaching, they can have the confidence to share their enthusiasm, expand on the curriculum and teach it in an engaging way.

They don't have to rely on textbooks and teaching students to cram for exams.

They can do what scientists do: ponder a problem, design an experiment, unpick the results, and think about what they might mean.

But let's not pretend it is easy. It takes effort, by individuals and institutions, to bring what really seems like a simple experience to fruition.

Mathletics may be a complement, but it is no substitute.

So I think it is time to re-think how we prepare our teachers and how we support them:

- to strengthen their content knowledge
- to maintain it at contemporary levels
- to instill the confidence to deliver the curriculum in interesting and novel ways, with relevant pedagogical development.

I think we need to have a conversation about the value and importance of teaching.

We need to have that conversation in the science community.

We need to have it with the Australian people as well.

I began with a ten year old boy, and I might finish there as well.

He will be finishing school in about 2022. On current government policy, he should expect to keep working to 2075 – or even further.

I don't think we can imagine what the world will look like on the day that he retires.

But we can be confident that our decisions today will make a difference: to that boy and the Australia he will know.

I hope we will do justice to the true potential of both.

Thank you.