Australian Government

Chief Scientist

PROFESSOR IAN CHUBB AC

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25 MINUTE SPEECH FOLLOWED BY Q&A

A FAIR GO IN SCIENCE FOR ALL

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TREASURY THEATRE

EAST MELBOURNE

Every year Forbes compiles a list of the world's most powerful people; and the world's most powerful women.

In an ideal world, we wouldn't need separate lists - or the names would overlap far more often than they currently do.

Such as they are, they make for an interesting study.

Of the ten **women** named as the most powerful in the world, no fewer than **six** had a qualification in the disciplines we know as STEM – science, technology, engineering and mathematics.

Of the top ten **people** - nine men, one woman - there were **four** with such credentials.

That count excludes Bill Gates, who ranked sixth and would no doubt have completed his science studies at Harvard – were it not for the fact that he liked making money with science far more than he enjoyed studying it.

Outranking him at number 4 is the current Pope – and you might think, a non-starter.

But not so. This Pope graduated with a chemical technician's diploma, and worked for a few years in that capacity in a food science laboratory before finding his way to the seminary.

So we have a science-trained Pope – and science-trained people at the helm of China, Germany, Brazil, the IMF, the US Federal Reserve, Walmart, IBM and General Motors.

> [We also lay claim to ten of the state finalists on the stage at the Miss America pageant last week, all studying STEM subjects at tertiary level. The White House put out a media statement in their honour.[1] But I digress.]

I admit that the sample size here is small.

[1] http://www.whitehouse.gov/blog/2014/09/16/we-geeks-miss-america.

As a scientist, I am not sure how far to trust in a metric described as ‘our collective wisdom at Forbes’.

So I will resist the urge to triumph prematurely. Instead, I want to think about these lists as a pixel in the larger picture: the story of a changing world.

Wherever we look, science is reshuffling the cards - on a scale we often struggle to comprehend.

It is estimated, for example, that scientific and technological advances have produced roughly half of all US economic growth in the last 50 years.

Our own Productivity Commission puts 65 per cent of Australia’s economic growth per capita from 1964 to 2005 down to improvements in the way we work — made possible in large part by science.

All this is opening our horizons, just as it closes the book on entire categories of industries and occupations.

- It is closing down Government offices and opening websites in their place.
- It is pushing out the span of our lives, and making life so convenient that we do want to stick around.
- It is building fortunes and putting people out of business.

We are told we are ‘a nation in transition’ – but to what, there are few prepared to say.

And we are just a tiny fraction of the seven billion people striving for opportunity in the world today.

Who wins from that seven billion? Who bears the costs of change?

And how willing are we as a nation to alter the balance?

I have been thinking and talking about these issues for some time. This month I put my ideas to the Australian Government in the form of recommendations.

I am not one of those who is content to see progress enrich the few, when it ought to be empowering the many.

I hope I can speak to the aspirations of us all.

And I think we do worry about the direction of change, when we turn our minds to it. We worry in particular about our children.

A child commencing school this year will make their senior subject choices in 2025. They might enter the labour force in 2030. On present policy settings, they will not leave it until the year 2080.

If that child were to Google '2080', they would see the extent of popular knowledge as collected on Wikipedia: a Doctor Who episode, a science fiction novel, and a vague prediction that China will be doing quite well.[2]

In other words, the sum total of our collective ignorance.

One thing **is** clear: in a world of rapid change, what will count is your capacity to adapt. And that has a lot to do with your education.

British author Ian Leslie has spoken of a growing 'cognitive divide' as the trend that defines our times:

> *Economies are rewarding those who have an unquenchable desire to discover, learn, and accumulate a wide range of knowledge.*

[2] http://en.wikipedia.org/wiki/2080s.

It's no longer just about who or what you know, but how much you want to know.[3]

That is backed up in the data released last week by the OECD.[4]

- It splits **generations**. Close to 40 per cent of 25-34 year olds across the OECD now have a university-level education, a **15 percentage point lead** on those nearing retirement age. In many countries, the gap is much greater.
- It splits us into **classes**. Those with a tertiary education are likely to earn twice as much as the median worker.
- It **perpetuates the divide in hard times**. On average across countries, 5 per cent of working age people with a tertiary degree are unemployed – compared with 14 per cent of those who dropped out at secondary level.

Of course there is more than one subject in the school curriculum, just as there is more than one way to be curious about the world.

The fact remains that curiosity and science have always been closely entwined – and they are now both inseparable from opportunity.

- The ABS has found that jobs commonly held by people with science credentials are growing at 1.5 times the rate of non-science jobs.
- That aligns to international research, which suggests that 75% of the fastest growing occupations require science skills and knowledge.

[3] http://www.newstatesman.com/culture/2014/05/why-curiosity-will-rule-modern-world.
[4] OECD (2014). *Education at a Glance 2014*. See http://www.oecd.org/newsroom/educational-mobility-starts-to-slow-in-industrialised-world-says-oecd.htm.

There are going to be more jobs in science occupations, and there are going to be fewer and fewer jobs than can be done without some degree of science literacy.

For a long time, we have been taught to think that people with STEM degrees who don't practice in STEM fields have failed. Or that we have failed them, by diverting them from their destiny in accounting.

When the Pope and Miss America have something in common, I think it is time to adjust our ideas.

The capacity:

- to think analytically
- to gather and assess evidence objectively
- to work in teams on solving problems
- to see the world in question marks not full stops –

these are the hallmarks of the high achiever in any field.

We don't all have to be scientists – but we should all be capable of understanding what they do. We need to cultivate that desire to know.

There is something exhilarating about the prospects we might open, for people who might not be rich in material terms.

We **can** say to our children that study pays returns.

We **do** see smart people rising up the ranks of the Forbes league table.

But can we also say the reverse – that failure is a matter of choice? That those at the bottom of the heap belong there? That the market now sorts us out on merit?

There are some who would. But I am not so sure.

I worry, for example, about the fact that the average mathematical literacy of our children, as measured by PISA scores, varies so widely from state to state.

I wonder how it can be that children in the ACT perform at a level that would rank them 13th in the world – when children in the Northern Territory would rank 42nd.

The difference is equivalent to almost two full years of schooling.

Children in Victoria would rank 20th – about the level of Irish children – today.

I turn to PISA's counterpart, TIMSS – the Trends in International Mathematics and Science Study.

I see that 67 per cent of city students perform at intermediate level or above. 40 per cent meet that bar in remote communities.

Regional communities split the difference, at 55 per cent.

Economists may disagree - but I am not prepared to accept that ability is decided by postcode.

Nor am I prepared to settle for an Australia in which these divides can emerge and grow.

We can tie ourselves up in knots pitting Shanghai against Sweden, or neuroscientist A against neuroscientist B. We can certainly waste a lot of time berating teachers.

The basic principle is surely very clear. Young people raised in a supportive, inspiring culture are more likely to succeed, and it is our duty to provide that in schools.

That means we have to stop thinking that science can be taught by textbook.

It is not a matter of force-feeding content for regurgitation in exams. It is about instilling a mindset, a passion, a way of approaching the world.

- Pondering a problem.
- Designing an experiment.
- Unpicking the findings.
- Drawing conclusions that we can support.
- Seeing the broader potential for that knowledge.

That is how science is practised, and that is how it should be taught.

I agree that it takes a special kind of person with a specialised form of training.

We don't provide that today – we seem to go out of our way to do the reverse.

Too few high-performing science and maths graduates aspire to teaching careers – and I don't think it's too hard to guess why.

Let's be blunt - we are recruiting from an ever-shrinking pool.

Australian schools show a decline in the rates of participation in 'science' subjects to the lowest level in 20 years.

We are not helped by Vice-Chancellors who do not want to trouble their target market with anything so noxious as course prerequisites.

We cannot wonder that so many of our graduating teachers are able to bypass science and maths at higher levels altogether.

Or that they might lack the confidence to teach the subjects themselves.

It is daunting to be asked ‘why’ when you worry you don’t have an answer.

And so when our students come to make their senior subject choices the choice is already made – for anything that frees them from the textbook.

And by the time those students come to university they find themselves taking bridging courses to meet the requirements of a business degree – let alone a qualification in STEM.

Then we wonder why it is that industry struggles to recruit the STEM-trained workers that it needs.

We wonder why only 45 per cent of Australians of working age have anything more than the bare minimum level of numeracy required to function in the modern world – again according to the OECD.

We wonder why we are as a society so poor at telling the snake oil from the science.

We start to appreciate that we are not just looking at a problem in schools – although it is manifested and perpetuated in the classroom.

And so I think we have to approach it on that scale. This is the central theme of my recommendations to Government.

It is also my message to the many Australians who care deeply about these issues. We need to work together.

I want teachers to think about what is happening in industry, so they can show students the pathways into jobs. Equally, I want industry to have an eye to the content of the school curriculum.

I want our media and popular culture to be backing the message that children receive about science in schools.

So we all need to shift our thinking - from science at the margins to science at the very core. At the core of our agenda – and at the heart of what we think of as Australian.

Education is one of the pillars we must get right – but as part of a broader strategy that allow teachers to do their job well.

There are many ideas in my document, and the linkages between them are just as important as the measures themselves.

But the first measure to be reported in the media was perhaps the simplest – and most important.

It was nothing more or less than this: a properly trained and supported science teacher, in every Australian school.

So simple we wonder why it isn't the case today. So difficult in practice we have never achieved it.

We are capable of better things – and I hope we will have the courage to demand them.

Thank you.