Australian Government

AUSTRALIA'S CHIEF SCIENTIST

PROFESSOR IAN CHUBB

MATHS OF PLANET EARTH CONFERENCE OPENING

15-MINUTE SPEECH

RYDGES HOTEL, MELBOURNE

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********** CHECK AGAINST DELIVERY **********

Good morning.

When it comes to science, technology, engineering and mathematics, my role as Chief Scientist does not allow me to favour one over the other.

But when I was approached to be the Patron of the Mathematics for Planet Earth, I said yes immediately.

Suffice to say mathematics is centrally important, to all of us.

Mathematics is the only subject whose study consistently enhances performance across all fields of science.

It forms the basis of most scientific and industrial research and development.

Increasingly, many complex systems and structures in the modern world can only be understood using mathematics.

Much of the design and control of high-technology systems depends on mathematical inputs and outputs.

This places it right in the middle of modern societies in developed countries like ours as we seek to compete in an increasingly competitive world.

Mathematics provides the vital underpinning of the knowledge economy, essential in the physical sciences, technology, business, financial services and many areas of ICT. It is also of

growing importance in biology, medicine and many of the social sciences.

Mathematics enables us to probe the natural universe and to develop new technologies that have helped us control and master our environment, and change societal expectations and standards of living.

Most of the great innovations that have changed the way people live over the past two centuries were enabled by mathematics.

Without mathematics, there would be no cars, no planes, no mobile phone networks, no electric lights, and no computers.[1]

The world's mathematicians are specialists at modelling and problem solving.

Their ability to help address the challenges facing our planet – like climate change or how population growth impacts resources – must be emphasised and not just by the people in this room but people out there. Let me come back to that point later.

As part of the global community, Australia needs maths and we need mathematicians. But they also need us. Now.

[1] Hyam Rubinstein (2009) *A National Strategy for Mathematical Sciences in Australia*

If we continue on our current trajectory, it is possible we will not have the right amount or the right kind of maths and mathematicians when we need them, and where we need them.

We're already seeing signposts, warning us of the consequences of complacency.

A couple of years ago, the Australian Industry Group said more than 75 per cent of employers responding to a survey reported that their businesses were affected by low levels of (literacy and) numeracy.[2]

More recently, a project looking at the maths skills of commencing bricklaying apprentices within a regional TAFE showed that 75 per cent could not do basic arithmetic such as adding numbers with decimals or subtraction requiring 'borrowings', 80 per cent could not calculate the area of a rectangle, or the pay owed for working 4½ hours and 20 per cent could not interpret millimetre measurements from a centimetre/imperial calibrated tape measure [3,4]

So how did we get to a situation like this?

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[2] Australian Industry Group, (2010) *National Workforce Literacy Project: Employer views on workplace literacy and numeracy skills, their impact on business and the most effective measures for improving skills*

[3] GippsTAFE Trade maths project (2009)

[4] Industry Skill Council (2010) No More Excuses- An Industry Response to the Language, Literacy and Numeracy Challenge

Firstly, we have had a declining interest in maths among our secondary school students and have moved slowly to address the root cause of this – our supply of and support for adequately trained maths teachers.

In 2007, 53 per cent of Year 7 to 10 maths teachers indicated they had at least 3 years' tertiary education in the field. Three years ago it had dropped to 46 per cent.[5]

In the same period, the number of Year 11 & 12 maths teachers with at least 3 years' tertiary education in the field went from 68 per cent, down to 64 per cent.[6]

Most of you would be acutely aware that the most difficult teaching positions to fill around the country are in mathematics.[7]

So what are principals supposed to do if they can't find someone who has studied maths at university for at least three years and then done a diploma of education?

They have little choice but to hire teachers to teach outside their area of expertise.

And this is the crux of the problem. This is where the work must be done. This is the trend that must be reversed.

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[5] Australia Mathematics Sciences Institute (2013) *Discipline Profile of the Mathematical Sciences 2013*
[6] Australia Mathematics Sciences Institute (2013) *Discipline Profile of the Mathematical Sciences 2013*

[7] Australia Mathematics Sciences Institute (2013) *Discipline Profile of the Mathematical Sciences 2013*

Teachers who lack confidence in their subject area, run the risk of relying on the textbook as a crutch to get by. That in turn runs the risk of not engaging students and losing them to the subject forever.

Less students continuing on in the subject means we don't have the mathematicians we need to meet our challenges and lift productivity.

It also means we don't have enough students who will go on to become the inspiring maths teachers of the future.

And so that downward trend begins again and potentially worsens.

That must have an impact on university numbers.

Put these in an international context, and the picture for Australia is grim.

Males enrolling in maths degrees in Australia (both undergraduate and higher degrees) is about half the OECD average. For women it is a third of the OECD average.

The number of graduates in mathematical sciences degrees is also about half of the OECD average.[8]

[8] Australia Mathematics Sciences Institute (2013) *Discipline Profile of the Mathematical Sciences 2013*

So we are not just facing a diminishing of our mathematics capacity. We risk losing our place in the world.

And those who argue that we need less maths graduates, not more, because they struggle to find work or don't do jobs matching qualifications appear to not understand the centrality of mathematics (or STEM skills more broadly for that matter).

A cross-section of Australian CEOs and senior executives from listed companies reported that they needed to add intellectual value to their products and innovations through skills in commercialisation, communication, computing, hardware and software development, optimisation, risk analysis, modelling and engineering disciplines.

They had a general expectation that graduates from science, engineering and allied degrees should have the requisite mathematics skills.[9]

That is their expectation. Is it being met? Indications are that they are not.

That is why I now have a National Advisor for Maths & Science, Education & Industry, working in my office.

Dr Roslyn Prinsley's job is to specifically address the issue of emerging STEM skill shortages.

[9] Australian Academy of Sciences (2006) Mathematics and Statistics: Critical skills for Australia's Future- The National Strategic Review of Mathematical Sciences Research in Australia

Part of her role is also to champion the role of mathematics and statistics, science and engineering across education and industry and work with these sectors to try and fix the supply line.

And while that work continues, I am keen to do more.

I'm sure all of us are frustrated by how much time we spend talking about this situation that confronts, how much time we've already spent talking about it. Decades.

So, we could decide that we're going to stop talking and try and do something differently. We could commit to a purpose. We could make Australia better.

We could do that by bringing alignment, focus and scale to the scientific enterprise of which we are all a part.

We could dare to try to change the culture, our culture.

For example we could say that the 18 per cent of time spent on teaching 'mathematics' in primary schools is not enough because surveys suggest that only about one half the community can cope with the mathematics needed for everyday life.

We could say that we will turn around the decline in intermediate or advanced maths enrolments in secondary school and that fewer kids will ever say it is too hard or too boring.

We could say that we would get better at helping employers to recognise the benefits employees offer beyond their narrow discipline. Then maybe we can do better than 9 doctorates per thousand in the workforce, when Switzerland has 28.

We could do all of that. And we could do more.

But small programs and incrementalism will not give us the change we need to be the nation we should be.

In a few weeks' time, I am going to present a National Science, Technology, Engineering and Mathematics Strategy.

My hope is that it will be the game-changer this country needs to earn the future it wants.

More than that, this change will come about not because of some sense of entitlement on our part, but because the community wants it to.

The time for talking is over. We can no longer afford to be timid. I look forward to having much more to say on that in a few weeks' time.

But for now, let me wish you luck over the next few days as you gather to discuss how mathematics and statistics can be applied to address the challenges facing the world.

In particular, can I encourage you to do some networking and seek some cross-disciplinary connections outside your comfort zone.

The collaboration arising from this is often where the real value of gatherings such as this can be found.

So it gives me great pleasure (as Patron of Mathematics for Planet Earth) to declare this conference officially open.

Thank you.