

# Status of Teaching: Submission

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## Addressing the Terms of Reference: Status of Teaching – Innovative Maths Focus

*The House of Representatives Standing Committee on Employment, Education and Training will inquire into and report on the status of the teaching profession, considering opportunities to improve outcomes in a range of areas including:*

***ToR1. Increasing the attractiveness of the profession for teachers and principals, including workplace conditions, and career and leadership structures.***

Teaching has always been regarded as a profession although teachers have traditionally not always been paid. It is the most important profession, our society could not operate without expert teachers turning out the skilled workforce that runs our transport, fixes our machinery, grows and cooks our food, ‘writes’ our computer programs, recovers from our computer disasters, builds our roads and bridges etc. Restoring the title ‘Professional’ to teaching is a first step towards making this important ‘profession’ more attractive.

The work that Maths teachers do is absolutely essential to the way our economy / society functions. Outside the Arts, almost everything we do has a mathematical foundation. This applies to business, law, sport, cooking, gambling, telecommunications, information-technology, AI (real or artificial), logistics etc.

Maths teachers are under even more unjust pressure than the pressure that teachers of other subjects experience. While few people would judge themselves to be sufficiently expert to criticize the way subjects such as English, History, Geography are taught, a surprisingly large percentage of people are willing to express their ‘expert’ opinions about a) What is a good Maths teacher and b) How to teach Maths. Unfortunately when ‘experts’ work for large IT companies that have products to sell, their views may prevail.

### ***1.1 What is a good Maths teacher?***

Historically this question was easy to answer and the expertise of graduating students was easy to measure as Mathematicians filled important positions in society. Maths teaches students to think logically and numerically. The actual skills that are needed to perform complex tasks are usually learnt ‘on the job’ – there is no alternative.

Nowadays people with very little Maths expertise feel free to criticize very capable Maths teachers using any criteria that springs to mind. Maths teachers may be too strict (or lax), give too much (or little) HW, expect too much (or little) from students, encourage students to perform beyond (or below) the expectations of their peers etc. International Vendors may devise criteria to ‘prove’ that a given Maths teacher is incompetent, we may ignore them.

Experienced Maths teachers with decades of excellent experience may face enormous pressure to resign decades too early. They are replaced by newly qualified teachers who may

find that teaching Maths is very challenging without the assistance of their experienced colleagues.

NB: America is facing a similar situation and a billionaire is (or was recently) hiring every sacked Maths teacher and employing them to teach Maths. Hopefully Australia will not have to follow a similar path.

Each person who teaches Maths properly is an excellent teacher. Each person who teaches Maths expertly is a Professional Mathematician, far more so than a person who does a repetitive job in a business environment. Lesson plans need to be crafted for individual students, the results evaluated and those unexpectedly difficult problems that gifted students discover need to be solved.

In a similar way, an expert History teacher, for example, may be a Professional Historian.

Society is absolutely dependent on the expert Professional Maths Teachers who teach the next generation so splendidly. Let us remunerate them as well as we reward people who do easier jobs in administration and in the Finance industries.

### ***1.2 How to teach Maths.***

We are inundated by the opinions of international Vendors on this topic. We may ignore them as they generally do not have the requisite Maths skills or experience to make informed comment.

#### **1.2.1 Junior Maths**

Junior Maths may be the easiest subject to teach because students already know much of it. The “1, 2, 3, many” attitude has been applied to “inferior” races over the millennia. Apparently it so got up Plato’s nose that he devised a test with a slave boy to prove that Maths is innate in the human species. I have recently devised a test that is superior to Plato’s, educating (educare = draw out) Y1-type primary students to do their times tables in less than an hour. This removes their Maths phobias and allows them to succeed in Engineering, Finance and other mathematically oriented subjects.

#### **1.2.2 High School Maths**

It is very difficult to teach High School Maths to students who cannot manipulate numbers and who do not understand the basic Mathematical concepts. Last week I was assisting a Y10-student with a ‘complete the square’ exercise. He had to ask twice “Where’s the square?” before I realized what the problem was and drew a parabola (*a parabola*) for him.

If Junior Maths has been taught well, then High School Maths is very easy for numerate students. I have a gifted Y4-student who does problems that would make some HSC-students scratch their heads and a gifted Y10-student who addresses post-graduate topics with gusto, both arrived in Australia quite recently. I showed Euclid’s Postulate-1 I studied it in Junior High) to the Y10 student and he was amazed.

Expert Maths Teachers seek out areas of strength and of weakness in all new students who come along, with poor understanding of terminology being a prime issue. Expert Maths Teachers are able to see where each topic fits into an integrated schema and structure their lessons accordingly, catering for advanced students as well as for the bulk of the class.

It is important to realize that 17 year old geniuses are capable of doing world-class Maths (and Music etc) and our top students could be encouraged to follow their example. It may be important to present top students with real world Maths problems that really do require a solution and such problems are available in abundance.

Is rote-learning advisable? It certainly is for Music and excellent Music students go on to be very creative. Similar criteria appear to be true for Maths and a limited amount of rote-learning may be applicable in some cases. “Educare” (draw out) may form the basic rule for teaching Maths at all levels.

### ***1.3 What is a bad Maths teacher? Artificial Intelligence teachers?***

Almost every mathematically skilled human has the potential to be an excellent Maths teacher, explaining concepts, solving problems and encouraging students. Such skills accumulate over the decades, we always improve.

By contrast, some AI-teachers may be ‘bad’ teachers (and bad chess players). A human or AI teacher that simply looks the answer up in the back of the book would normally be classified as a bad teacher.

This may be the approach that some AI-chess programs, storing billions of possible moves in a database and choosing the strongest move based on statistics. This is not ‘playing’ chess and a parallel approach is not ‘teaching’ Mathematics.

Categorizing AI-machines as ‘good’ Maths-teachers and criticizing good human Mathematicians as ‘bad’ Maths-teachers is a very effective way to diminish the status of our excellent Teaching Profession.

I am an IT expert and AI-machines certainly have a place in the teaching profession. Expert Mathematical analysis may be necessary in order to determine how to use AI-teachers in a productive way.

***ToR2. Provision of appropriate support platforms for teachers, including human and IT resources.***

#### **2.1 Curriculum.**

It is important that the Maths Curriculum be consistent, challenging, relevant and designed by expert Mathematicians and Maths Teachers. ‘Expert’ advice from international Vendors could be ignored.

A few of Euclid’s proofs were included in our Junior High curriculum. I do not like rote learning so I never learnt them. I do know where they were and can discuss them with experts and with students. Should we recreate a focus on innate-learning, then there would be ample time to devote to Euclid and to Australia’s brilliant traditional mathematics. New Zealand is not shy of their traditional Maths and their record in producing world-class Mathematicians may be the best in the world on a pro-rata basis.

#### **2.2 Expert Teachers**

Newly graduated Maths Teachers need the expert advice that only experienced Maths Teachers can provide. We may try to keep all Maths teachers in employment as long as they wish to work. There is an abundance of work for Maths Teachers and current attitudes of

encouraging experienced Maths Teachers to retire early may be unnecessary and counter-productive.

### **2.3 IT Resources**

While IT-facilities can be very useful when teaching a range of subjects, they are certainly not as essential as international Vendors may claim. For decades teachers have been told that it may be difficult to teach properly without brand-X computers. Students were also told that they may be able to learn more effectively if they used the brand-X computers. The evidence appears to be that standards have dropped since computers were introduced into classrooms.

The Internet may be useful for doing some research but teachers who rely on the Internet may become predictable. Apparently one student changed some Wikipedia information just before an exam and students dutifully reported the incorrect Wiki-information. As a general rule, information on the Internet has not necessarily been controlled, may be inaccurate and easily copied.

Current reliance on videoed lessons to explain difficult concepts appears to correlate with a sharp drop in standards, especially in Maths. Teachers need to be able to see when a student does not understand a prerequisite concept such as ‘completing the square’. Students need to be able to question a teacher. As it is difficult to question a machine, students’ eyes tend to glaze over as they watch videos. Bertrand Russel experienced similar issues when he tried to use cinema to teach Maths to the world.

AI (Artificial Intelligence) is perhaps the next Big Thing in education although each AI-vendor seems to have their own definition of what AI is. When I was working as a Top Consultant in Holland, I invented an AI-component in 1980 (a Matrix Approach) and a second component in 1991 (interactive calls from a C-program to an Oracle database). While modern AI may use these components, there may be issues with some dodgy AI-maths, with Governance and with the quality of some Big-AI-data. By contrast, my Matrix Approach encourages Governance and IT Security and these are big issues in both Business and Education. Additionally my Matrix Approach tends to provide affordable and reliable products.

It may be better not to rush into new technology until it has been thoroughly tested. Few people would advise teachers to use the technology that was being introduced two decades ago. By the same token, our technology may appear obsolete within a few years, it ages so quickly.

I follow what successful countries are doing with technology in the classroom. It appears we are not following their example. IT skills such as coding are essential in our modern computer-oriented society. Coding is, of course, essentially a Mathematical skill (with Logic) and the great IT pioneers in Europe were Mathematicians such as Pascal and Leibnitz. I am proud to continue their work.

### ***ToR3. Identifying ways in which the burden of out-of-hours, at-home work can be reduced.***

Excellent Maths Teachers always have the burden of out-of-hours work. They need to create new lessons, set new exams, correct students’ work, solve unexpected Maths problems and research their topics. They should be recompensed for this work.

***ToR4. Investigating ways to increase retention rates for the teaching profession, and avoid 'burn out' among early-career teachers.***

For mathematics, the best way may be to retain experienced Maths Teachers who can provide the assistance that newly graduated Maths Teachers require. This strategy has been effective for a long time but the current strategy of encouraging Maths Teachers to retire early does not appear to be producing the required results.

***Tor5 (Other). Professional Knowledge and Professional Approach***

Professionals such as Doctors and Teachers have always been acknowledged as having an expert approach to current situations that more commercially-oriented people would possibly not have.

NB: I have just discovered that my role model may be Kolmogorov, who was one of the most important Mathematicians of the last century and far better than I am. Like him, I started researching local traditional (Koori) Maths and culture during my student days. He invented some brilliant Statistical-theory and focused on early childhood education in his latter years. I invented some IT-tools we use today, am researching Statistical-theory and have a strong interest in early childhood Maths education. Kolmogorov was well rewarded for his brilliant career.

A professional approach is even more important when knowledge changes (or appear to change) with such rapidity. As an example, some of the Mathematical content in Hardy's excellent book "A Mathematician's Apology" may be out of date due to modern technology.

Nowadays research topics may be re-researched on a regular basis as the associated knowledge is quickly lost - even when it may be true. True Maths is important, I make no apology for defending standards that are appropriate. Appropriate infrastructure and a closer adherence to The Constitution may promote a locally-based Knowledge-approach.

By contrast, Professionals may drown in information that may not be true. As an example, we recently saw a very clever and well-educated person exclaim "It's just Siri getting excited" in a Royal Commission. Computers do not have emotions and cannot get excited. They may perhaps simply do what they are programmed to do. Such programs may now be invisible.

Professionals such as Doctors and Teachers may need to be a repository of Knowledge and Professional Wisdom if Society is to reward them for being true professionals. One such item of knowledge may be that "Maths is innate in the human species".

Plato discovered this a few thousand years ago and I have recently developed a new approach that proves and perhaps extends Plato's conclusion. Good Luck!

Yours Sincerely

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