Submission to the Productivity Commission Review of NSRA

Dr. Marty Ross

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To The Productivity Commission,

I am a mathematician who has long taken an interest in, and has written tens of thousands of words on, mathematics education in Australia.[1] I will make my submission brief. I will not provide much argument or evidence to support my submission, although this would not be difficult. But I see no point. The Productivity Commission will have no shortage of comprehensive submissions from mathematics education experts arguing in a polar opposite direction, and I cannot fight an army. I have tried.[2] I simply want to attempt to awaken you, to have you begin to consider that perhaps the PC's automatic respect for such mathematics education experts, and the framework to which they have handcuffed you, might be due some critical examination. Then perhaps the members of the PC might begin to ask the right questions of the right people.

The stated objective of the NSRA is that Australian schooling provide "a high quality and equitable education for all students". I would have thought that now, as ever, such a high quality education must be focussed upon the solid and deep delivery of the three Rs, the foundation of all other disciplines. As a mathematician, I will focus here on the third R, which, for the Productivity Commission, does not exist.

There is no third R in the PC's call for submissions. There is no M. The terms "arithmetic" and "mathematics" do not once appear. How can that be? How can a national review of school education fail to mention such a fundamental discipline?

The PC might argue, and the mathematics education experts definitely argue, that there is no need to consider "mathematics", since *numeracy* effectively covers the territory. On occasion, the claim is that numeracy is synonymous with mathematics; more often the claim is that numeracy is superior to mathematics as a focus for school education. These claims are, in turn, false and absurd.

Numeracy, to the extent that it is anything coherent, is concerned with the *application* of mathematics. Learning to apply mathematics is of course a worthy goal, but it is not the only goal, and it is not the main goal.

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[1] https://www.qedcat.com/ and https://mathematicalcrap.com/.

[2] https://mathematicalcrap.com/2021/05/26/the-acara-page/.

Before one can apply mathematics, one must learn the mathematics to apply. The mathematics education experts will of course agree with this, but such agreement is hollow. Their agreement is belied by the undeniable fact that numeracy is supplanting mathematics as the focus of Australian school education. Their agreement is belied by the Productivity Commission's own call for submissions, the words that are used and the words that are omitted.

This focus on numeracy not only undermines the teaching of mathematics. Ironically, it also undermines the teaching of numeracy. The core concept at the centre of the direct application of mathematics is quantification. Any such application, unless it is contrived and trivial, then requires strong arithmetic skills. But these arithmetic skills are not taught effectively in the muddy waters of application. It simply cannot be done. But, this is exactly what Australia is attempting.

Beyond, the more sophisticated application of mathematics requires generalisation and abstraction and pattern recognition. For this, the key concept is *algebra*. As I have written elsewhere,[3] algebra is *everything* in mathematics. Algebra is how we name the quantity we're after, setting the stage for its capture. Algebra is how we signify pattern, allowing us to hunt for deeper pattern. Algebra is how we indicate the relationship between quantities. Algebra is how Descartes captured geometry, and how Newton and Leibniz captured calculus.

The heart of primary school mathematics is arithmetic. The heart of secondary school mathematics is algebra. That is all. Consider what the Asian powerhouses of mathematics education choose as their focus. You will not find much there in the way of numeracy. What you will find, well beyond anything else, is solid arithmetic and solid algebra.

The message for the Productivity Commission should be clear. In the first part of its first "information request", the PC seeks the key drivers of "academic achievement". But, the National Measurement Framework is not stately concerned at all with achievement in mathematics, only in numeracy. As such, the Productivity Commission is prima facie enquiring about the key drivers of something that is barely worth measuring and is most definitely not central. The Productivity Commission might ask itself - must ask itself - how did this come about?

Burrowing down, the PC's call for submissions lists six measures/sub-measures of achievement in numeracy. Might we then discover some testing of mathematics hidden under the guise of numeracy? Yes, but very little.

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[3] https://mathematicalcrap.com/2020/01/25/the-slanted-tower-of-pisa/.

The six measures/sub-measures of achievement in “numeracy” amount to the performance on three national or international tests: NAPLAN, PISA and TIMSS.[4] Of these, only TIMSS includes any solid testing of arithmetic and algebra.[5] PISA, a test for 15 year olds, contains essentially no algebra. NAPLAN, which contributes four of the six measures/sub-measures, contains no arithmetic or algebra that is not trivial or very close it.

PISA and NAPLAN are useless, and they are worse than useless. They occupy space and attention, taking away the opportunity and interest in the proper testing of proper school mathematics. Yet, the Productivity Commission’s first stated concerned is on the key drivers of achievement on these pointless tests. And thus my answer to the Productivity Commission: Why bother?

Kind Regards, Dr. Marty Ross

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[4] ACARA (Australian Curriculum, Assessment and Reporting Authority) 2020, *Measurement Framework for Schooling in Australia 2020*, Sydney.

[5] It is commonly accepted that Australia performs well on TIMSS. This acceptance is erroneous.