

SAVING AUSTRALIAN MATHS

THOUGHT FOR THE MONTH (#6.1)

Philip O'Carroll Sept 2018 phil3068@hotmail.com www.philipocarroll.com share at will responses welcome

Australia is a top spender on school education. But UNICEF ranks Australia educationally 39th out of 41 high- to middle-income countries.¹ I know how to solve this problem. At no extra cost.

BACKGROUND DISCOVERY

Before my wife Faye and I met and founded **Fitzroy Community School**, I had been a Lecturer in Logic at the University of Western Australia. Before that, as an undergraduate at Auckland Uni, I had served some years as a part-time paid Logic Tutor to a great variety of undergraduates.

As a logician, I discovered that virtually everybody, regardless of education, uses logic flawlessly in everyday life. If using a language familiar to your audience, not changing the meaning of a key word from one statement to another, and not distracting them with points irrelevant to the core argument, you have to construct an unusually elaborate argument to cause them to lose track of the deductions and draw the wrong conclusion.

Formal Logic requires people to learn some new tools: precise definition of some new terms, meanings of symbols and the rules of reasoning. If these essentially simple concepts are explained clearly, it is amazing what variety of people can master Formal Logic. If not precisely and sequentially explained, students will of course get lost and say, as many do, *Oh, I can't do Logic*.

AN UNFORTUNATE STATISTIC

Similarly, there is a substantial proportion of the Australian population who say, with a special tone of defeatedness, *Oh, I can't do Maths*. It sounds just the same as when people say, defensively, *Oh, I can't dance*. Of course, almost everybody could in fact dance. But, given that no-one has kindly

introduced most people to dance steps in the right order at the right pace, many are overwhelmed by a fear of making a fool of themselves.

The Maths problem is exactly the same. Many children have not been shown the right steps of Maths, in the right order, at the right speed. They have been moved on to further Maths classes without the necessary prerequisite steps having been mastered. They become progressively more embarrassed at their "incompetence" and can't wait to escape Maths classes forever – without realising that it was not them, but the teaching program that was incompetent. Ouch!

APPLYING MY EXPERIENCE TO SCHOOL MATHS

When Faye and I started our primary school, I became the Maths teacher for all grades from Prep to Grade 6.² I was convinced, from my earlier experience with Logic, that there is no need for any child to drop out of Maths. Maths is simply the logic of numbers.³ In 40 years, our school has never produced a Maths dropout.⁴ This explains how our little alternative school, which has **never selected** children for enrolment⁵, and always **includes all** of our students in the official external assessment program, consistently scores⁶ highly in the national Maths outcomes.

How do we produce these results? First, we have replaced conventional early Maths textbooks. Today's usual early Maths problems are buried in English. Many potentially excellent mathematicians have Maths readiness before their English skills develop.⁷ They cannot read the English well enough to tackle the Maths problems. They simply conclude that they are no good at "Maths" and give up. We can't afford to lose them this way. **The early years are critical.**

¹ Sydney Morning Herald. Pallavi Singhal, 16 June '17. Also Matthew Knott (30 Nov '16), who put us behind Kazakhstan.

² I was the Maths Master for 25 years.

³ Some of the rules even have identical patterns. Compare numbers $2 \times (5 + 3) = (2 \times 5) + (2 \times 3)$ with statements $A \text{ and } (B \text{ or } C) \Leftrightarrow (A \text{ and } B) \text{ or } (A \text{ and } C)$

⁴ This claim may not include every child who attended our school for only a short period.

⁵ We only select parents, to save our outward-bound philosophy (of adventurous activities) from being undermined by over-anxious parents.

⁶ Our Yr 3s equally divided into Bands 5, 6 & 6+.

⁷ Literacy develops later in their primary years.

Many Maths educationists seem to think that Maths must be introduced to children by way of practical applications from everyday life. This is a mistake. Maths has an amazing structure all of its own, which is fascinating to children. They will delve into Maths for its own sake. The more humanity explores the world, the more kinds of phenomena submit to uncannily elegant (simple) Maths formulae.⁸ Bring in workaday applications, involving language, **after** the first few years of getting acquainted with the **universal patterns**.

I could not find suitable Maths books for my early years. So I wrote my own smaller booklets.⁹ These were different in several ways:

- 1) The booklets do not require the student to be good at English. The action required of the student is, as much as possible, self-evident. A common example: show one or two problems already solved and then display further similar problems with gaps to be filled by the child.
- 2) Each page of mathematical activity would be only a small step from the previous page. Teacher checks the completed page before the student proceeds with the next page. By the end of the booklet, the child will have thoroughly mastered an essential Maths skill.
- 3) There is a small instruction in fine print on each page for the teacher or aide or parent to read out if a child can't understand what was expected of them on that page (a rare event).
- 4) One whole booklet focuses on the same principle throughout.¹⁰ This ensures thorough mastery of the one operation – rather than dealing with a smorgasbord of Maths concepts, each only vaguely understood.
- 5) The booklets follow a logical sequence. **One booklet must be completed before the next booklet is issued.** This sequence is followed throughout the primary years. **There are no gaps or overlaps between grades.**

I can hear teachers who read this already saying, *but how are you supposed to successfully run a class like this?* I have the answers to this question.

⁸ Classic example: $E=mc^2$ [energy, mass, speed of light]

⁹ About 40 booklets in all, each having about 28 x A4 pages.

¹⁰ E.g., addition to 10, adding lengths, adding money, subtracting money, fractions of (wooden) logs, paddocks and pizzas, levels of decimals, etc, with some revision thrown in.

¹¹ We tell them about *the tortoise and the hare*, a great story from *Aesop's Fables*.

- a) There is no “class” as such. Every child in the room is working on **their own** booklet, the one they are ready for. Thus no child is drowning, losing confidence, and doomed to eventually give up. Simultaneously, the faster students, are not held back, not in danger of getting sick of “boring” Maths classes.
- b) What about the faster students mocking the slower students? We avoid that by explaining to the children that everyone learns skills at a different speeds, which can change over time. Just as different children have growth spurts at different ages.¹¹
- c) When a child is stuck, they bring their booklet to the teacher, who explains the procedure in language suitable for that child.
- d) Given there are several different booklets being worked on in the same room, how does the teacher prepare for the class? There is no preparation. The teacher cheerfully jumps from one Maths topic to another.
- e) Where will we find such agile Maths teachers? Simple, **employ your best Maths teacher(s) to teach all the Maths** (as in secondary school).¹² School results will lift overnight – without your having to spend a cent more on staff!
- f) What if there are too many children in the queue? It's amazing how short the queue usually is. Some children never come to the teacher except to start a new page or a new booklet. This is because they selectively tune in to what the teacher is saying to those in the queue, and learn various Maths procedures in advance through multiple explanations.
- g) What if you have distinctly slower children needing longer explanations? There are times when it pays to **engage a willing parent, grandparent or retired teacher as an aide**.¹³

No child feels bored or overwhelmed. The result after seven years? The faster students are already well into secondary work. And our slower students discover in secondary that they are more secure in Maths than many of their classmates.

What is more, there are **no dropouts!** ☐

¹² FCS has a *Maths Room* for Maths. If you have very large classes and no aides, you may do better taking half a class at a time. I've always managed alone with up to 14 at a time.

¹³ It is important that everybody understands that an aide can join the class only by teacher invitation.