

## HOW TO LOSE FRIENDS AND INFLUENCE PEOPLE

MARTY ROSS

This article was published online by Arena [1] on Dec 16, 2022.

I am, or at least was, a mathematician. I lectured and I proved theorems. With my friend and colleague Burkard Polster, I also devoted many years to the popularisation of mathematics. We were good; Burkard still is.

Burkard and I were busy. We engaged endlessly with teachers and their students, and with the general public. For 111 years we wrote a “Maths Masters” column for The Age newspaper, amounting to 11111111 columns (the reader is invited to puzzle over that, or to just accept that it means “a lot”). The Maths Masters’ motivation and mantra was “to do whatever they can to convince whomever they can that mathematics is beautiful and fun”. We took hold of many whomevers over the years, and we convinced a decent few.

While Burkard was, and still is, happy to continue along this path, I slowly began to change direction. I became disillusioned with the underlying state of school mathematics, convinced that “beautiful” and “fun” were not enough and not the point. My “popularisation” work became more polemical, and Burkard and I began to resemble the cartoon characters Ren and Stimpy, appealing to our audiences, and now the education authorities, in very different ways. These days I am, in the main, an angry blogger. I try to change people’s attitudes not with beauty and fun but with strong and pointed critique. I get less public praise, but I am more comfortable with what I do.

In this article, I will try to explain my disillusionment. I will try to describe the manner in which school mathematics education has lost its meaning and proper purpose, and the causes of this. The reader is invited to extrapolate to other disciplines.

### GIVE WAR A CHANCE

When professional mathematicians as a body declare a school mathematics curriculum to be nonsense, this need not be accepted as unassailable truth. It is reasonable to ask for evidence and argument. But that is not the first step. The first step is to acknowledge that this declaration means something.

In April 2021, the Australian Curriculum, Assessment and Reporting Authority (ACARA), the statutory authority responsible for all things education, published a draft national curriculum up to Year 10 for public discussion. ACARA’s draft was amateurish and radical, and it ignited a curriculum war. I helped instigate the mathematics front of that war by co-writing an open letter, subsequently signed by many prominent mathematicians. Formal statements from peak mathematician associations soon followed, including a call for a halt of the curriculum review process.

Pressure from Alan Tudge, then federal Minister for Education, forced ACARA to give grudging consideration to mathematicians' concerns<sup>1</sup>. Following some token consultation, ACARA produced a redraft, which was then approved by the federal and state education ministers, with the new curriculum to be implemented in 2023.

With the war lost, mathematicians did not comment publicly on the new mathematics curriculum. Privately, they have expressed to me their dismay, with both the process and the final product: not one has suggested that ACARA's belated changes were sufficient to make the curriculum remotely acceptable; not one has indicated that the new mathematics curriculum is an improvement over the current, already impoverished one.

LET  $x = x$

I cannot possibly convey here all that is wrong with ACARA's curriculum and, more generally, with mathematics education. Noting a very few of its shortcomings will have to suffice. One of its fundamental failings is the treatment of algebra, by which measure the new curriculum falls short by a country mile.

Algebra is the beating heart of mathematics. It is the naming of the quantity being hunted, setting the stage for its capture. It is how we signify pattern and how we express the relationship between quantities. You want to understand something else, probability or statistics or geometry? Algebra is essential. Algebra is how Descartes captured geometry, and how Newton and Leibniz captured calculus.

A fundamental insight is that algebra is simply arithmetic, just with numbers we don't know. The current curriculum states this clearly, in a Year 7 instruction to "Extend and apply the laws and properties of arithmetic to algebraic terms and expressions". By contrast, ACARA's new curriculum instructs Year 7s to "generate tables of values from visually growing patterns or the rule of a function; describe and plot these relationships on the Cartesian plane".

This is pointless, and it is not algebra, except in the most trivial sense. It is substituting data entry and graphical busywork for the critical practice of algebraic skills. The curriculum is choked with such nonsense, strangling the few stray instructions that might otherwise engender proper study. The term "algebra" and the critical discipline of algebra have been distorted to meaninglessness.

#### THE TIMES TABLES THEY ARE A-CHANGING

There is, to recoin a phrase, no royal road to algebra. A mastery of algebra requires practice and memorisation and struggle. And preparation. Prior to the arithmetic of numbers we don't know comes the arithmetic of numbers we do. In order to understand  $\frac{a}{b} = \frac{c}{d}$ , we must first understand  $\frac{4}{6} = \frac{6}{9}$ . This is the work of primary school. It is work undone.

The (continued) undermining of arithmetic was a widely reported aspect of ACARA's draft curriculum, an aspect then stenographically reported as "fixed" in the approved, "back to basics" redraft. The reports were absurd. Notwithstanding ACARA's surrender on a few key points, the new curriculum gives no proper weight to written skills, with the traditional methods for arithmetic barely present and nothing good or even coherent in their place.

---

<sup>1</sup>For an analysis of ACARA's empty and arrogant defence of their draft, see [2], and more generally [3].

The treatment of mental skills is little better. Automatic recall of the multiplication tables is critical to all the arithmetic that follows: a student cannot apply  $4 \times 9$  if they are struggling simultaneously to remember it or calculate it. The multiplication tables were mangled in the draft curriculum and then fixed, but only up to a point, where they are referred to as “multiplication facts”<sup>2</sup>. This is weird and telling. Much worse, the tables (still) only reach  $10 \times 10$ , rather than the traditional  $12 \times 12$ . This matters. We have 60 minutes in an hour and 360 degrees in a circle for a reason. Having natural multiples and factors and fractions readily at hand is critical for the learning of arithmetic.

The ignorant decision to exclude 12 turns out to not matter, however, since few students even get to 10. The large majority of primary school students do not learn their multiplication tables. This is because, clear curriculum direction notwithstanding, the very large majority of primary school teachers do not consider the tables important, much less mandatory. Teachers have been fed other ideas.

#### THE THINK SYSTEM

ACARA’s new curriculum is a large but entirely predictable step down. Modern education is steeped in grandiose perversion, with innovative but misconceived practices working not to improve but to undermine fundamental processes of understanding. There is Higher Order Learning, and 21st Century Skills, and Flipped Classrooms, and Child-Centred Learning, and Discovery Learning, and Inquiry Learning, and Play Based Learning, and on and on and on. Underlying almost all of this is the philosophy of constructivism.

Built upon the tautology that we only understand what we understand, constructivism claims that students must construct this understanding through their own experience. Constructivist approaches are to be contrasted with the boring old practice of directly teaching students, and in particular the teaching of clear facts and skills. Always lurking is the boogiemán of Rote Learning. This boogiemán in particular has frightened teachers away from orderly “tables” and into embracing isolated “facts”.

There is a proper and important role for mathematical exploration, but that role in primary education is limited. It took thousands of years for civilisation to come up with the crystal concepts and truths and techniques of “elementary” mathematics. Constructivism is the slowest and most painful and least successful method of mastering these fundamentals.

Not everyone, however, sees this as a drawback. A teacher focused on students’ Higher Order Thinking may have little concern for the lowly basics. Mistakenly. Rather than basic facts and skills being opposed to deeper thinking, the basics are the foundation for deeper thinking. Before twenty-first century skills, whatever these might be, there must come a mastery of seventeenth-century skills.

---

<sup>2</sup>In launching their draft curriculum, ACARA made a preemptive attempt to assure the public that multiplication tables “will always have a place in the mathematics classroom” (The Australian, 29 April 2021). Instead of referring to the times tables, however, ACARA referred to “time tables”, and elsewhere (in a now deleted FAQ) to “timetables”. One needn’t be Freud to glean its true thoughts.

## YOU GOT A PROBLEM WITH THAT?

Hand in hand with constructivism goes problem-solving, one of the great con jobs of mathematics education. Mathematicians love the idea of problem-solving, since it is a one-word definition of what they do. Mathematicians love to see children working on authentic, well-structured problems, with clear mathematical content and purpose. But school problems are different. School “problems” are typically poorly defined, open-ended explorations with no measure of or concern for success, and with students ill-prepared for a venture of any significance. These problems are all the worse for almost invariably being about something other than mathematics, about a largely fictitious Real World. Thus, rather than a carefully crafted problem about prime numbers and factors, students “explore” or “model” the painting of walls and the graphing of mortgage rates. Students are presented with pseudo-problems that require little thought and inspire less.

ACARA and the education authorities regard the Real World as a great selling point. Hence the new curriculum has a stream on “Space” rather than geometry. Hence NAPLAN has a test on “Numeracy” rather than arithmetic. Hence the mandating of statistics way beyond its very limited pedagogical worth. Hence the unceasing focus on STEM, which reduces mathematics to an instrumentalist, utilitarian skill set. This all fits in well enough with the neoliberal notion of education as training, but it is otherwise reductive, and it erodes the basis for mathematical thinking. Real Worldness in school is almost invariably contrived, and thus as boring as dirt, because we simply need very little mathematics for our everyday lives.

Such Real Worlding also feeds back to devalue and to poison the teaching of mathematics. The critical point of mathematics, the source of its incredible power, is that it removes the distracting noise of the world. Mathematics abstracts from messy reality to create something much simpler, something that can be analysed and honed and generalised. And yes, mathematics then gives back, providing indispensable tools for the understanding of real-world phenomena. But the mastery of these tools is beyond the scope of school mathematics for any but the most banal of real-world situations. What results is simply the glorification of noise – the presentation of noise as the central topic of mathematics education. It is absurd, and disastrous.

## THE MEDIUM IS THE MESS

Eddie Woo is Australia’s mathematics teacher superstar. Thanks to his incredibly successful Wootube channel, Eddie is adored by pretty much everyone. I am less adoring.

The problem is not with Eddie Woo, who is undeniably engaging and who teaches in the main in an effectively direct, traditional manner. The problem is with the electronic medium, which encourages passive acceptance rather than active contemplation. Even when a mathematics video is done clearly and correctly, and that is not always the case (including on Wootube), only a small fraction of those viewing will follow in any meaningful manner. The vast majority will simply be tricked into believing they understand more than they do.

Mathematics education wastes untold time and energy and goodwill on electronic media: students watch videos instead of reading; they “move” shapes on screens instead of shifting physical blocks; they push calculator buttons instead of computing

on paper; they “prove” statements by pressing Solve or Graph on their handheld computers<sup>3</sup>. Education has reframed Magritte’s playful reminder of reality to be an insidious falsehood: a teacher can now present a picture of a pipe and declare, “Yes, that is indeed a pipe”.

Plenty are fooled by constant references to “visual learners” and “digital natives”, but there is no fooling reality. The perverting effect of these media is that students are not required to think or to reflect. They need never pay proper attention, to a teacher or even to their own thoughts. The electronic media stimulate and entertain, occupying the space where contemplation might have occurred. In his 1986 book *Amusing Ourselves to Death*, Neil Postman wrote on the effect of television on education: “The name we may properly give to an education without prerequisites, perplexity and exposition is entertainment”. That is where we are, except that now television, and much worse, are in and are intrinsic to the classroom.

#### HOW TO SUCCEED IN EDUCATION WITHOUT REALLY TRYING

Few students can succeed in any meaningful sense in the current environment. If they do, it is largely as a result of their own conscientiousness, or as the gift of a maverick teacher who, ignoring all contrary instruction, has chosen to teach. Or else the parents have taken the reins, either teaching at home or resorting to the burgeoning black market of tutoring.

With few students succeeding, it is important that this lack of success be neither measured nor mentioned. Mastery is no longer a goal, much less a requirement. Instead, students are encouraged to “go at their own pace”, even if that pace is glacial. Education wizards wax lyrical about setting problems with “a low floor and high ceiling”, failing to mention that few students ever leave the floor. Students’ reports do not report. Clear and critical truth is forbidden.

Primary schools do not test, unless one counts NAPLAN, and one should not; two tests in seven years, on numeracy rather than mathematics, is meaningless. In junior secondary school there are tests, but the tests are gamed. A parent may believe that 70/100 on a Year 8 maths test is pretty good, but the parent is typically unaware that the test likely consists of 60 % that is trivial, 40 % that checks basic facts and skills, and 0 % of anything requiring deeper thought; that 70/100, therefore, likely indicates 10/40 on the basics, which should ring the alarm bells but does not. Eventually, the nature of the game is clear, but by then it is too late, with the misguided student’s only option for senior mathematics being to continue with the poorest of the very poor offerings.

Education authorities must claim success, however, and they do so by redefining it. The measure now is not students’ mastery of mathematics, but how students feel about mathematics classes. ACARA’s curriculum does not once refer to mastery but repeats the nauseating phrase “positive dispositions” with equally nauseating regularity. Education academics write endlessly about “maths anxiety” and “growth mindset”. The message is that students are neither to be fed nor annoyed, merely pleased and pacified. What matters, à la Postman, is that students be entertained. Ironically, it is likely that the lack of core skills leads to the very “anxiety”

---

<sup>3</sup>The unceasing emphasis on image has also helped destroy the traditional and critically important medium of textbooks. Almost without exception, modern school texts are unreadable: bloated, error-strewn, poorly worded, calculator-pandering and infantilising.

that education academics are so keen to avoid. After more than two decades of innovative methods, new technologies and student-centered pedagogy, all indications are that “maths anxiety” is increasing, not declining.

#### THE PAST IS A FOREIGN COUNTRY

And the name of that country is Singapore. For instance.

Asian countries dominate TIMSS, the international test of school mathematics. Asia even dominates PISA, the anti-algebraic non-test created specifically so that Western countries would feel better about themselves. Even if one wishes to concentrate upon ACARA’s snake-oil games, it turns out that attention to the basics is the way to go.

Australia once did much better, although that was long ago and is largely forgotten. The powerful forces of entertaining have been at work for many decades. Moreover, there are two intertwined forces, one political and one philosophical, which have directly perverted mathematics education.

First, the political. Historically, for good and bad, Australian mathematics education was carefully controlled by education bureaucrats under the guidance of mathematicians. In the 1970s, teachers started to be given more autonomy. Also around that time, a fourth group, of education academics, was beginning to emerge as a force. Since then, and with varying overlaps and alliances, these four groups have tussled over the nature and control of mathematics education. All-out war broke out in the early 1990s, with the bureaucrats attempting to wrest control from the other three groups. The bureaucrats failed, but the downward slide was well underway. The power of education academics has continued to grow, and they are now much more closely wedded to the bureaucrats. ACARA’s current mathematics curriculum was very much the work of education academics, and the new curriculum even more so.

The current domination of the mathematics curriculum, and teacher training, by education academics need not be bad, but it is because of the second, intertwined force. With mathematics education academics now in possession of their own world, they are generally much less connected than they once were to the world of mathematics; they are less adept at and less interested in it. This lack of mathematical expertise encourages and necessitates an emphasis on other, non-mathematical concerns, laying the fertile ground for constructivist obfuscation. Much more time is spent in apologising for and avoiding the difficulty of mathematics than is ever spent addressing that difficulty, or in demonstrating the beauty and the power that can result from proper effort. It is telling that not a single mathematics education academic has said a public word in opposition to ACARA’s draft curriculum or the approved redraft. They are made naked by their silence.

In February 2022, there appeared a federal report into Initial Teacher Education (ITE). Among the report’s numerous trivial and beside-the-point recommendations, one stands out. Recommendation 13 is concerned with the lack of teaching experience of education academics. It states that:

*higher education providers should prioritise recent classroom experience for academic staff in ITE to ensure they are keeping up to date with contemporary teaching practices.*

This is wrong. What ITE academics should be doing is raiding nursing homes, ripping the respirators off ex-teachers and demanding that the codgers use their dying breaths to impart their soon-to-be-lost wisdom.

Students are not learning, and one of the things they are not learning is not mathematics. We are a million miles from sane mathematics education.

#### REFERENCES

- [1] Arena <https://arena.org.au/do-the-maths-why-mathematics-education-is-failing-our-kids/>
- [2] M. Ross, <https://mathematicalcrap.com/2021/09/29/acaras-response-to-amsis-submission/>
- [3] M. Ross, <https://mathematicalcrap.com/2021/05/26/the-acara-page/>