WHAT’S five times four? Geophysicist Peter Ridd was gobsmacked to see a first-year university student pull out a calculator to work out the no-brainer equation.

The James Cook University professor blames the dumbing down of a generation of Australian students on modern teaching philosophies that deride rote learning as “drill and kill”. His alarm is echoed by eminent maths, science and education professors concerned that underqualified teachers, “student-led” pedagogy and assignment-based assessment methods are rendering a generation of Australian children innumerate.

“Modern educational theory says you don’t need knowledge because it’s all online; there’s Google,” Ridd tells Inquirer. “But you ultimately do need a basic proficiency in spelling and numbers; you need knowledge inside your head. I’ve seen uni kids, when I’ve asked them ‘What’s 61 x 0?’, pick up a calculator.”

Scientist Jennifer Stow, a former Harvard University researcher with a PhD from Monash University and a postdoctoral degree from Yale, shares Ridd’s dismay. As laboratory head at the University of Queensland Institute for Molecular Bioscience, and a principal research fellow with the National Health and Medical Research Council, she teaches science to undergraduates and trains PhD students.
Counting the cost of national maths failure | The Australian

Stow is “flabbergasted” by what she views as substandard skills in maths and English among many Australian undergraduates. Foreign PhD science students outnumber the locals in her field, she says, because local students are so far behind in maths.

“They can’t do basic maths,” Stow tells Inquirer.

“A lot of them haven’t learned the times tables at school, they haven’t been drilled in spelling and they come to university not being able to do division.

“There are lots of international students at university now, and kids from places like Singapore have got much better reading, writing and maths skills than the Australian kids.”

The sliding standards are spelled out in the latest results from the OECD’s Program for International Student Assessment. The international PISA test, last conducted in 2012, reveals the numeracy levels of Australian teenagers have plunged so far in a decade that four out of 10 lack “baseline” maths skills.

Australia’s maths performance in Year 10 fell by the equivalent of six months of schooling between 2003 and 2012. Australia dropped from 11th to 19th place in the league table of 65 countries. China, Singapore, South Korea and Japan topped the class; the average 15-year-old from Shanghai is 1½ years ahead in maths than a typical Australian student. Just 15 per cent of Australian students were top performers, compared with 55 per cent in Shanghai. One-fifth of Australian students were ranked among the poorest performers in maths, in contrast to 3.8 per cent of Chinese students.

The national curriculum for maths has won broad support from maths teachers and university educators. Kevin Donnelly, one of two educational experts appointed to review the curriculum for the Abbott government, believes style and quality of teaching count as much as the content.

“If it’s not rigorous, and teaching isn’t explicit and well structured, you do get into trouble,” he tells Inquirer. “There needs to be rote learning, memorisation and mental arithmetic so it becomes automatic. The fashion for the past 20 years has been very much against memorisation and we need to bring that back.”

The steady decline in mathematics performance in Australian schools has resulted, in turn, in a shortage of qualified maths teachers. Thousands of children are being taught maths by teachers who specialised in humanities subjects at university.

“At high school the person teaching physics is more likely to be a physical education teacher than someone qualified to teach science,” notes Ridd.

Forty per cent of Australia’s maths teachers are “out of field”. Queensland’s Auditor-General has revealed that one in eight maths B teachers in years 11 and 12, and one in three maths teachers in years 8 to 10, lacks a tertiary qualification in maths. Four times more phys-ed teachers graduated from Queensland universities than maths teachers in 2012. The audit noted a shortage of maths, science and technology teachers in high schools — but an oversupply of physical education, music, drama and dance instructors.

Stephen Norton, a senior lecturer in mathematics education at Griffith University’s school of education and professional studies, tests the numeracy of all his would-be teachers. The results are worrying: the average undergraduate teacher has the maths skills of a Year 7 student. Half would
struggle with a Year 9 National Assessment Program — Literacy and Numeracy test, which measures basic levels of literacy and numeracy for 14-year-olds.

Norton believes most university teaching courses fail to demand “reasonable levels of numeracy” from trainee teachers. Instead, course lecturers concentrate on teaching “learning theories, the role of technology, mathematics of indigenous cultures, learners’ attitudes towards mathematics and curriculum trends”. A typical four-year teaching degree, Norton says, dedicates just 32 hours to the teaching of maths.

“Every year I test my students and they’ve got the understanding of a Year 7 or Year 8 kid,” he says. “Maybe 25 per cent have a good knowledge. They struggle with fractions and proportional reasoning and anything to do with algebra. I believe it is our responsibility in universities to make sure we can remEDIATE that.”

Norton is critical of schools’ emphasis on “inquiry-based teaching” at the expense of drills and memorisation. Performance is falling, he says, “not because our kids are dumber; it’s because they haven’t got the basics”.

“We’ve got to find a balance where we don’t stifle creativity but we give students the basics to apply in higher order ways,” he argues. “On the one hand, we want kids to discover how to do things themselves and be persistent and resilient. But what happens when you have inquiry-based pedagogy, with teachers who don’t really know the discipline and don’t emphasise the basic skills, is that children end up falling behind.”

One example of the modern “student-directed learning” style is the maths homework set for 10-year-olds at a Brisbane state school this week. “Write a reflection that highlights at least 2 areas in maths that you feel more confident about as we draw to the end of Year 5,” it says. “List at least two target areas that you would like to work on and explain what strategies you will use to take responsibility for your learning.”

Ridd, the James Cook University scientist who despairs at the reliance on calculators for simple sums, is highly critical of Queensland’s unique but controversial assessment methods for high school maths. While other states and territories rely on regular external testing of kids’ maths ability, Queensland high schools set a series of written assignments that can be 10,000 words long.

“We (scientists) want someone who can solve an equation and add fractions,” Ridd says. “The Queensland Curriculum and Assessment Authority wants someone who can write an essay. The problem for us is the mark that comes down from the high school is a very poor predictor of whether the students can do simple maths. The subject has been hijacked by education theorists who have no idea what’s going on.”

A Queensland parliamentary inquiry has recommended that external testing be introduced for 50 per cent of students’ marks in years 11 and 12 — in line with the southern states — with a limit of one written maths assignment each year.

The Liberal National Party government, having sat on the findings for 14 months, is now promising a “draft response” by Christmas. This week it published a vague “30-year vision” on education reform, which referred to the need to “attract, retain and reward the best and brightest teachers”. It will appoint 300 “master teachers” to 463 schools next year. Queensland is also reviewing its OP system,
which ranks students on their “overall position” in relation to other students, without external exams.

It is telling that Education Queensland’s selective Academy of Science, Mathematics and Technology — reserved for the state’s brightest students — has shunned the official curriculum. Instead, its students study the International Baccalaureate Diploma, which the academy describes as a “program for rigorous learning and assessment”.

Matthew Dean, a researcher and former first-year lecturer at the University of Queensland school of mathematics and physics, believes teachers who let kids use calculators at primary school are “ruining children’s lives”.

In a submission to the national curriculum review, Dean explained that technology had a “smart end” consisting of the creators, and a “dumb end” of consumers. “Rather than making all Australian students and parents pay to be at the dumb end of technology, a good education system would give students the freedom to one day be at the smart, creative end, if they so choose,” he wrote. “The way to this freedom and ability is through mastering mathematics — the power of thought behind science and technology.”

Dean likens reciting the times table to learning musical scales on the piano: boring and repetitive but essential to mastering more advanced pieces. Having lectured first-year maths students at university for five years, he notes that many have knowledge of mathematical concepts but not the skills to solve problems. “It’s as if they’ve done a mathematical appreciation course,” he says. “They know of things but don’t have the skill to do it themselves.”

Nationally, the number of Year 12 students enrolled in advanced maths has fallen 22 per cent in a decade, choking the supply of graduates for research institutions and industry.

The Australian Mathematical Sciences Institute is warning of a looming skills shortage for industries such as banking, mining, information security, IT, biotech and communications.

Stow, whose groundbreaking medical research is tracking the movement of proteins within cells, complains that high school students are getting “dumber by the minute”. She champions a return to the times tables and spelling bees in primary school. “There is no substitute for rote learning and it is the only way to build neural networks and imprint things into your brain,” she insists.

A surgeon, Stow argues, has no time to Google in an emergency. “You can’t operate that way,” she says. “You need a certain amount of basic skills and instant recall to do the job properly. You’ve got a computer; it’s called your brain.”

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