"Help! My Students Can't…": A Collaborative Multi-disciplinary Approach to Strengthening Students Essential Maths Skills for Science

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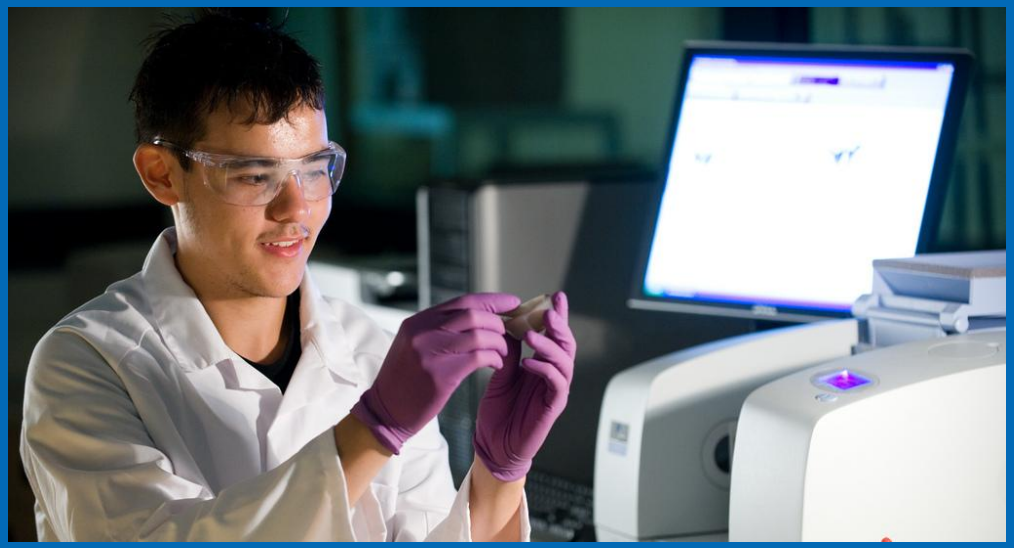

The place

Federation University Australia - a new regionally focused University as a result of a merger between Monash University's Gippsland Campus and The University of Ballarat

(SASE) School of Applied Sciences and Engineering at Gippsland

Our students

Federation University actively encourages direct entry via a variety of pathways.

So our cohort includes:

- Year 12 ATAR
- Mature age direct entry
- Pathways (e.g: TAFE)
- Off campus

The degree structure

Bachelor of Science course requirements include a compulsory first year mathematics unit as well as a first year statistics unit.

All our tagged Science degrees require significant Biochemistry (MedBioSci, VetBioSci and Biotech)

Many of students haven’t done a lot of science at secondary school, e.g. many VetBioSci students come in with only psychology or biology.

Initial design by the Mathematicians

- Demonstrate competency with **basic calculation skills** required for science including calculations involving **percentages, proportions, ratios** and fractions.
- To be able to recognise un**it prefixes** and confidently convert between units.
- To be able to manipulate a wide range of **algebraic equations** in order to substitute values and to transform **to solve** for a particular variable. To be able to solve systems of linear equations.
- To be able to perform calculations involving **area, surface area and volume** on a range of two and three dimensional shapes.
- To be able to use functions involving **powers, logarithms and exponents**.
- To be able to present data **graphically** and use numerical summaries.
- To be able to use a spreadsheet tool to **graph experimental** data including correct labelling and the use of error bars.
- To be able to use the above knowledge in **practical problem solving**.

Multi-disciplinary problems

Biology: My students can't read pipettes

Chemistry: Significant figures, scientific notation, ratios (for serial dilutions)

Biochemistry: Transforming equations

Maths: Logical set out of work

Stats: Logs

How confident do you feel about rearranging the following equations to make the yellow term the subject?

$$ln\frac{K_2}{K_1} = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$ ☹ 😐 ☺

$$\mathrm{E} = E^0 - \left(\frac{RT}{nf}\right)\ln Q$$ ☹ 😐 ☺

School ‘wishlist’

- Rounding / significant figures and scientific notation
- Dilutions, ratios
- Logs and exponentials – reversing logs and exponentials
- Fractions (Fluency in their use)
- Algebra – transforming equations
- Molar calculations for chemistry
- Mixing ratios and conversions – ppm, ppb and ppt as well as %.

Some surprising wishes

- Can you teach my students how to use the equation editor in Word? Oh, and how to correctly write up a sample equation for a lab report? (And how to correctly format results for lab reports, and to make good graphs….)
- We told you we didn't need calculus, but we do need students to have a basic understanding of the concepts of calculus and its connection to graphs, rates of change = gradient and curves. Areas under curves.

What we learnt

- Use your colleagues' expertise to provide in-context examples of problems they need the students to be able to solve.
- Essential maths for scientists is more than just arithmetic and algebra skills.
- The new maths unit emphasises mathematical literacy such as using a mathematical argument to support a claim within a report as well as presentation of mathematical material using digital media.