opinion

Mathematics teachers 'telling it like it is'

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"No, you will never have to write out a congruence proof in real life."
"No, you will never use calculus again."
"Yes, you can just Google the answer."[1]

If, from a young age, students were taught that mathematics is not simply number-based content to be memorised but rather, in its purest form, is about acquiring and mastering a logical thought process, there would be less time dedicated to justifying why the learning of mathematics is important. In reality, students are unlikely to find themselves in a devastatingly life-changing situation should they not be able to demonstrate the congruent nature of two triangles. However the approach a student may choose to implement in dealing with the aforementioned situation is integral to the outcome. Learning experiences in mathematics foster the development of skills (including evaluation, reasoning and logical stepwise thinking) which all serve as invaluable tools for life beyond the classroom. So, why are mathematics teachers not more honest when addressing the questions posed by students? Why are they afraid of 'telling it like it is'? Why are we as teachers not making the relationship between mathematics and thinking processes clear enough that students also come to appreciate the content?

In our quest to justify its importance, we tend to over-complicate mathematics with 'authentic' applications. Although implemented with the best intentions for promoting deeper learning, this authenticity often does not support the overall understanding of concepts, as our students are armed with very little life experience. Controversially, this notion challenges innovative pedagogy that is driven towards the development of 'soft skills' through contextually authentic learning experiences. However, in the process of trying to make all mathematical content relevant, the foundations on which mathematics is built are being overlooked in classrooms.

Additionally, would we be answering questions pertaining to the usefulness of mathematics so frequently if the subject was taught by specialist mathematics teachers in Years 3–6, similar to that which occurs in Years 7–12? It is simply not fair to expect teachers of Years 3–6 to be experts in English, mathematics, science, PE and art. Without regular and coordinated exposure to subject specialists, the emerging perception is that superficial learning of fundamental and transferable skills is 'good enough'. We strongly advocate for a change to the current model of primary education.

[1] Applicable to all persons, with the exception of engineers, physicists and those that are able to comprehend the value of skills such as reasoning, evaluation, critical and logical thinking, questioning, and problem solving, to life beyond the walls of a mathematics classroom.

The suggested changes to the traditional model of primary education would undoubtedly:

- establish the concrete practicalities of systematic mathematical thinking thereby limiting the 're-teaching' time required of secondary school mathematics teachers;
- bring a clear focus to the continuum of learning associated with mathematical capabilities;
- create a culture in which students are ready for, and receptive to, the cognitive challenges of deep learning;
- minimise 'mistake anxiety' associated with the lack of foundational skills, therefore increasing the motivation to attempt conceptually difficult subject matter;
- support a more seamless transition to high school; and,
- enable students to conclude, for themselves, that the systematic thinking processes can be applied across academic and general life pursuits.

To support our current position, we will look more closely at the introduction of coding into the curriculum across key learning areas. This move is related to a global trend that recognises the increased demand for task automation and accuracy. It is a misconception that a person requires high-level mathematics to code effectively. The skills that are actually required are those that are founded on the principles of mathematical logical and analytical thinking and, to some extent, the ability to utilise the scientific method. The misconception of the difficulty of coding, and of various other computer-based careers, has led to a declining number of students choosing to study mathematics and science, and will inevitably lead to a workforce which is grossly underqualified and unprepared to compete in the job market. The negative impacts of insufficient education will ultimately be catastrophic for the Australian economy.

Finally, both teachers and students need to embrace failure and recognise that in these moments there are invaluable opportunities to learn. Failure should be seen as genuinely exciting and not a reflection of a person's intelligence. Re-evaluation of a thought process can often lead to a far-reaching 'aha' moment, when the disjointed fragments of prior knowledge finally come together. Having the disposition to actively seek learning opportunities must be promoted from a young age, and having the confidence to recover from failure must be guaranteed within a safe learning environment established by the classroom specialist. Furthermore, the application of systematic thinking should be continuously encouraged and assessed, rather than the single answer outcome. Through this, students should be encouraged to apply continuous self-reflection to the strategies they choose to implement, by simply asking themselves "Does this make sense?" with reference to either the strategy utilised or the final outcome. A specialist mathematics teacher is equipped with the knowledge to allow exploration but the wisdom to guide within a sensible framework.

If we want to stop the resistance to mathematics, caused by its lack of perceived relevance, we need to have an honest conversation with our students, and to a greater extent within the teaching community. It is incumbent upon teachers to realise they can inspire a passion for mathematics, but not by way of 'window dressing', or by forcing students to learn content without a sound reason. Ultimately, improving education in mathematics is multifaceted (and not without challenges), and necessitates the skills of specialist teachers to work with students from a much younger age than is currently occurring.

Simply, the commencement of secondary school is often too late for specialist intervention.