

The Problem with Mathematics – An Actuarial Perspective

Stephen Wright¹

The number of students studying higher level mathematics in Australian high schools is declining. A report by the International Centre of Excellence for Education in Mathematics found the percentage of Year 12 students undertaking advanced and intermediate mathematics had fallen from 41.3 per cent in 1995 to 34.3 per cent in 2004.

Academics, politicians, industry organisations and high-end users of mathematics skills are beginning to sit up and pay attention to this looming crisis in Australian mathematics education.

The recent Mathematics Skills Crisis Forum in Canberra brought together major interest groups and organizations including the Association of Professional Engineers, CSIRO, academics from most Australian universities and members of parliament. The purpose of the forum was to debate the severity of the crisis and the possible strategies to solve it.

While the Institute of Actuaries of Australia (the Institute) has not yet seen a significant decline in university enrolments in the mathematics-driven Actuarial Studies, we do recognize that there is a growing loss of students studying higher level mathematics in Year 12. In some Actuarial Studies undergraduate programs, bridging mathematics subjects have now been introduced in first year to prepare students for the more demanding advanced mathematics.

Some other major professional bodies report that this crisis is impacting directly on their professions. The crisis is creating a vicious cycle that is slowly impacting on mathematics education. That is, fewer high school students are studying advanced or intermediate mathematics, which means fewer students are enrolling in university mathematics classes leading to a reduction in the number of mathematics teaching staff in universities and leading to lower numbers of enthusiastic, mathematics-qualified teachers in schools.

The cycle will ultimately result in a shortage of skilled professionals in the fields requiring tertiary mathematics education, including engineering, science, finance and the actuarial profession, all of which are areas on which our society and economy depend for continued prosperity.

Furthermore, a diminution of mathematics skills poses a threat to Australia's capacity to compete internationally. It is likely there will be increasing competition for mathematically-trained people, resulting in the need to buy-in skills and mathematics-reliant products, services and intellectual property from overseas. This has negative implications for our future research and development capability and for our nation's long term prosperity.

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So how can we encourage more students to study mathematics? How can we reverse this trend? While many groups are lobbying for changes to school curricula, increased training for teachers and fee cuts to mathematics university courses, the Institute believes that we must first get to the core of the problem, that is, promoting mathematics in our high schools.

If students are engaged in mathematics in high school, they are more likely to study it in university and move into careers utilizing this important skill base.

High school mathematics teachers can play a key role in promoting the value of mathematics to students in three simple but effective ways:

1. *Show students the rewards of a career using mathematics*

Fewer numbers of students studying advanced high school mathematics is translating to fewer numbers of students studying university mathematics. A report by Graduate Careers Australia in 2006 found 18.6 per cent of Australian employers had difficulties in recruiting graduates with mathematics, statistics or science education—a 12.5 per cent increase on figures reported by employers the previous year.

The problem is that many high school students are not aware of the vast and increasing range of rewarding careers available after studying mathematics at university. Students who enjoy mathematics are often uncertain about the careers to which a degree in mathematics can lead.

Teachers can engage students in the power of mathematics by promoting the range of careers that can utilize and reward these advanced skills. There are plenty of them. From biomedical engineers and scientists to research statisticians and financial modellers, mathematics skills can lead to challenging and high-paying careers. Mathematics-based careers also offer mobility and access to both the established and emerging world economies.

Take actuaries, for example. They use high-level mathematics expertise, statistical knowledge and problem solving skills to solve a wide range of practical business-related problems. What many students don't realize is that a newly qualified actuary can earn in excess of \$100,000 per annum in their first year of work and that's just in Australia.

By endorsing these careers and their various personal and financial rewards students are more likely to understand how mathematics can enhance their future careers.

2. *Tie in mathematics learning with the bigger picture*

Many secondary school students complain about repetitive mathematics exercises, particularly in the formative years of early high school. They don't see the point of this activity. If students are shown the big picture of mathematics and where the curriculum will take them, they are more likely to find the exercises meaningful. Students who would have been turned off mathematics at this early stage may continue on and develop further skills.

The big picture is that mathematics underpins so many critical technologies and processes we use in everyday life and appears in facets of every job. It is the foundation of banking, computing, financial planning, design and accounting. At an advanced level it is intricately involved in research and product development, quantitative analysis, engineering and actuarial work. Students not wishing to pursue a career

in mathematics often do not see that mathematics will benefit them in the future, and are unaware of the need to embrace these vital skills.

According to the report, *Mathematics and Statistics: Critical Skills for Australia's Future*, Australian CEOs and senior executives "have the expectation that graduates from science, engineering and similar degrees have the requisite mathematics skills" (2006, p.6). Significant mathematical preparation is required for careers that are not obviously related to mathematics, such as economics and commerce, dentistry and agricultural science.

By raising awareness of how mathematics is a part of everyday life and how these skills are required in varying professions, teachers will provide their students with the much needed context of mathematics learning. Mathematics skills, no matter what profession or career you're in, will equip you with problem solving skills for life.

3. Express a passion for mathematics

A teacher who expresses their passion for mathematical sciences will more likely win the hearts and minds of their students. As someone who is passionate about mathematics and education, I believe that this last approach in engaging students is the most crucial.

Students will be challenged and excited by mathematics if they are inspired by those who are teaching them. Mathematics is highly rewarding for those who excel in it and teachers are the key to nurturing the mathematics talent of all their students.

What else needs to be done?

Further to the Institute's suggestions to teachers in engaging high school students in mathematics, we believe that more work needs to be done at the Federal and State government levels.

Working taskforces need to be established to:

- Influence federal and state government policies to increase resourcing in university mathematics departments, provide further training opportunities for mathematics teachers, and increase incentives for students to undertake mathematics-related tertiary study
- Influence state governments to bring coherence and unity to the various state mathematics curriculums without compromise of standards
- Influence the state education boards and schools to highlight to students the rewarding careers that exist for those with advanced mathematics skills.

The Institute is in early stages of planning a program to encourage actuarial members to visit high schools to inspire mathematics teaching staff and students.

The declining interest in mathematics education in Australia is a well-recognized problem. Commitment now needs to be made in developing strategies and actions to attracting more young people to studying mathematics and the Institute believes that this begins in our high schools.

About Stephen Wright

Stephen was appointed as the Institute of Actuaries' Director of Professional Education in January this year. Stephen manages the Institute's professional education program and is responsible for the education processes that transform prospective actuarial students into fully qualified fellows of the Institute.

He has extensive experience in education in South East Asia, as well as Europe and America. Stephen has a Masters Degree of Adult Education as well as a Management Degree with a sub-major in Business Mathematics.