Queensland University of Technology

Submission to the Queensland Parliament's Education and Innovation Committee Inquiry into Assessment Methods for Senior Mathematics, Chemistry and Physics

May 2013

Mathematics

I write regarding the recent invitation to make a submission to the Parliamentary committee overseeing the inquiry into assessment methods for senior mathematics. As Head of School for Mathematical Sciences at QUT, I thought it important to convene a focus group to discuss the nature of our submission. This focus group discussed and debated a number of issues, including student competencies such as the basic understanding of key mathematical concepts and the ability to formulate mathematical ideas to problem solve. We also discussed the mix and balance of senior assessment practices, the importance of consolidating algebraic skills in the middle school, the increasing spread in entry-level student capabilities and confidence in mathematics, and the removal of mathematics prerequisites for some courses.

Although we do not have quantitative measures of the impact that the assessment practices in Mathematics B and C have on student preparedness for entry level studies in mathematics at university, we believe that the assessment and teaching practices support our key learning and teaching objectives and outcomes. The mix of assessment types and the use of integrated exploratory exercises generate a capacity for critical thinking and a sense of the applicability of mathematics. It is important, however, that assessment practices used in the senior years of high school should continue to support the authentic development of key competencies in mathematics.

We believe that these competencies fall under three main headings.

1. **Performing Standard Calculations**. We would hope that students could perform routine calculations using mathematics taught throughout the senior Mathematics B and C curricula and could critically assess the mathematical outputs that supporting technology might offer, for example, graphics calculators.

2. **Background Knowledge**. We would expect that students have a good understanding of the basic concepts of calculus, algebra and probability covered in the senior Mathematics B and C curricula.

3. **Problem Solving skills and Critical Thinking**. We were all supportive of students in senior mathematics subjects being exposed to the applications of mathematics as part of their senior Mathematics B and C assessment. Student projects embracing such learning practices should continue.

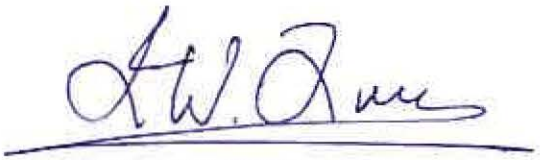
Regarding points 1 and 2 from above, results of past diagnostic tests performed on a cohort of science students who had completed Mathematics B at high school have highlighted the inability of students to handle multi-step problems. Even with just basic percentage calculations in a context, a 96% success rate at a single-step problem dropped to 72% when an extra step was added. We believe that the ability of students to take a problem through more than one step is something we take for granted that students do not seem to be taught enough of at school. Furthermore, with regard to algebraic skills, it was found that fewer than 50% could successfully solve a simple equation.

We would encourage the authorities charged with this review to take into consideration these three competencies listed above when formulating any plans to modify the current senior assessment practices. Whilst we understand that the use of technology is an important part of today's society, we ask that some careful thought be given to the use of calculators across all aspects of senior assessment. Another recommendation might be to consider in place of calculators, the use of spreadsheets to support learning in mathematics, from the early grades. There is significant research to indicate that these encourage abstract thinking and modelling, and aid the transition from number to algebra. Students are then required to either build structures or use existing ones; either way, mathematical understanding is fostered.

A much more pressing issue, in our opinions, is the generation of a nationwide strategy that attracts the brightest young minds back into the sciences and then retains some of these students for a teaching career.

Recent reforms of the School mathematics teaching in the UK are worthy of consideration in the Australian context. See Making Mathematics Count: The Post-14 Mathematics Inquiry http://www.mathsinquiry.org.uk/

We wish you well with the inquiry and hope that the desired outcome is one that encourages university academics to work alongside their QSA and teacher colleagues for the betterment of the national agenda around mathematics education.



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