Editorial – Welcome to Volume 23, Issue 1

This special edition of the *International Journal of Innovation in Science and Mathematics Education* focuses on the mathematical preparation of tertiary students. Specifically, the papers included consider the impact that assumed knowledge entry standards in mathematics may have on student progression in science, technology, mathematics and engineering programs in Australian universities.

Most universities in Australia have now abandoned hard prerequisite requirements for entry to university programs. Instead, eligibility for selection is based on the 'assumed knowledge' on which first-year programs of study are based. However, for a variety of reasons, including the imperative to achieve a high ATAR score, many students enter mathematics-dependent degree programs without the assumed mathematical background.

Mathematics Departments across the country have individually developed a variety of strategies, including bridging subjects and support centres, to assist their own mathematically underprepared students. However, high failure and poor progression rates continue to occur, creating significant challenges for tertiary mathematics educators and negatively impacting the number of students graduating from tertiary study with high-level quantitative skills.

In 2013, a workshop for tertiary mathematics educators was run as part of the First Year in Maths (FYiMaths) project[1]. Dealing with underprepared first-year mathematics students was identified as the single-most significant challenge these academics faced and they were frustrated by their attempts to support these students not having the impact that they intended.

In response to the depth of concern across the tertiary sector, the FYiMaths project supported by the Institute of Innovation in Science and Mathematics Education (IISME), organised a national forum at the University of Sydney to consider the broad impact of assumed knowledge in mathematics, not only on student achievement in mathematics subjects, but also in engineering and science disciplines where mathematics plays a crucial role. This forum, *Assumed knowledge in maths: the impact on student achievement and progression in STEM programs,* attracted 145 participants from across the sciences, representatives from almost all universities in Australia, and also included representatives from curriculum authorities and the secondary education sector.

In an opening keynote address from the Chief Scientist, Professor Ian Chubb, forum participants were urged to encourage institutions to provide clear information to

[1] The First Year in Maths project (2012-2014) investigated the role of First Year Coordinators in Mathematics in Australian universities. The project team conducted an extensive interview program, ran workshops and established a national network for tertiary mathematics educators. The FYiMaths project was funded by the Australian Government Office for Learning and Teaching. For further information go to www.fyimaths.org.au

prospective students about the importance of high-level mathematical skills to all fields of STEM education and employment. Invited presentations at the forum showcased a diversity of perspectives from disciplines including chemistry, biology, physics and mathematics, which showed that underpreparedness in mathematics poses an impediment to learning in a wide range of disciplines, not only in mathematics subjects.

The *Assumed knowledge in maths* forum provided a focal point for the widespread, and growing, concern at the falling levels of mathematics education in Australia, described by Professor Chubb as 'an issue of National importance'. Since then a Communique has been issued to Government bodies and our campaign continues to address the clarity of information provided to students about the importance of mathematics to their future study and career prospects.

In this special edition we include extended articles from forum presenters and participants that demonstrate the impact of students' underpreparedness in mathematics from various discipline's perspectives.

Caroline Bardini and Robyn Pierce look at how the inconsistent use of symbols and their meaning from secondary school to tertiary mathematics negatively impacts on student understanding.

Two articles look at the impact of students' mathematical background on their success in studying mathematics and science in their first year of tertiary study. The first, by Wendy Loughlin *et al*. provides a case study of the mathematical background of first-year chemistry students. Their research showed that students without the required mathematical knowledge did not perform as well in chemistry as those who did, with the most important factor in their success in chemistry being the strength of a student's mathematical background. The second, by Jackie Nicholas, Leon Poladian, John Mack and Rachel Wilson, analyses the impact of students' subject choices in senior secondary school on their progress in first-year mathematics at the University of Sydney. Their results show that the students who complete the higher-level mathematics subjects have a higher chance of success in first-year subjects.

Sue Gordon and Jackie Nicholas report on a qualitative study of students' understanding of 'assumed knowledge' entry requirements. Their results show that students' understanding of 'assumed knowledge requirements' varied widely. Andrew Wandel *et al*. present a comparison between staff and student views on students' level of preparedness for first-year mathematics subjects. They conclude that most students in their study overestimate their ability.

Leanne Rylands and Don Shearman's article investigates the connection between engagement and the use of learning support services for their increasingly diverse student cohort.

Janelle Wilkes and Lorelle Burton's article explores the effectiveness of diagnostic testing for first-year engineering and science students, in assisting them to develop awareness of their level of preparedness by highlighting areas where they may need support.

Irene Penesis *et al*. look at the creation of mathematics courses for pathways into engineering degree programs for Vocational Education and Training students, which involve mapping the mathematics curriculum to identify gaps in current bridging programs and developing online training modules.

Katherine Seaton details a major curriculum redesign necessitated by the change in prerequisites for degrees at La Trobe University. The article explains how the redesigned curriculum provides a range of pathways for students, and highlights the limitations of such a process as well as the opportunities to improve student pathways.

This special edition reflects the growing interest in the scholarship of learning and teaching in mathematics and the impact of mathematical skills on science education in Australia. The editorial team would like to thank the authors for contributing their work to this special issue, and also those who presented at the forum.

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