Editorial

Welcome to Volume 24 Number 3

Welcome to the Special Edition of IJ-ISME on the Link between Tertiary Science Education and Employability.

In recent years the value of tertiary education in Science, Technology, Engineering and Mathematics (STEM) disciplines and, more importantly, the translation of STEM knowledge and skills into the Australian workforce, has been high on the national agenda. Key reports have been commissioned by the Office of the Chief Scientist[1,2] and the Australian Council of Deans of Science[3] in an effort to examine a range of concerns. These include reasons for the decline in secondary students' interest in STEM disciplines, the increasing and unmet demands of employers for STEM skills in their workforce, and the challenges for STEM graduates in translating their knowledge and skills into the workplace.

Clearly it is unrealistic to expect generalist degrees such as the Bachelor of Science to prepare students for a diverse range of separate careers they may wish to pursue on graduation. Unfortunately, as a consequence, these degrees typically lack direct input and feedback from employers, and also important links between the knowledge and skills being acquired by students, to workplace practices and needs, are not embedded in the curriculum. In contrast, vocational degrees can be too specific, with graduates potentially lacking the agility required to respond to a changing world. A tertiary education that combines the benefits of developing a scientific way of thinking[3] with skills that enable graduates to integrate into a range of employment pathways will be powerful for students, employers and tertiary institutions alike.

In this special issue we showcase research that has identified a range of employer and graduate perspectives on identified needs and possible solutions to the dilemmas experienced in the STEM education-employability transition. Based on case studies of undergraduate and graduate degree programs, including examples of both coursework and research degrees, this volume provides some fascinating insights as well as examples of innovative activities and assessments, that enable students to apply their learning in the workplace.

In the first three articles the views of employers and recent graduates are examined. Gerry Rayner and Theo Papakonstantinou explore the range of different degrees offered by universities and the extent to which they develop the attributes valued by employers and align with the skills required of new recruits. Importantly these attributes are examined according to discipline, and include generic and interpersonal skills as well as the specific vocational skills required of the role. Narrowing the focus to undergraduate programs, Mahbub Sarkar and

[1] http://www.chiefscientist.gov.au/wp-content/uploads/NCVER_WIL-employer-perspectives.pdf
[2] http://www.chiefscientist.gov.au/wp-content/uploads/ACER_WIL-in-STEM-in-Australian-Universities_June-2015.pdf
[3] http://www.acds.edu.au/wp-content/uploads/sites/6/2015/04/BackgroundInScience-_web-Complete-2012.pdf

co-authors compare areas that graduates felt least prepared to tackle, when they first enter the workplace, with feedback from employers. Interestingly, communication skills were absent from the top of both lists; however, the lack of commercial awareness was highlighted by both employers and recently employed graduates as an important gap in student preparation for employment. In the third paper of this group, Trine Nielsen and Henriette Holmegaard share their study of Physics Masters graduates in Denmark. Of interest in this study is the fact that the employment rate is very high, concealing the significant challenges these graduates also face in managing their transition into the workforce. Many of the key findings of this study are broadly applicable to other cohorts of STEM graduates. These include specific discipline gaps in their education (such as programming and statistics), a narrow focus on their discipline making it difficult for students to see career opportunities beyond academic roles (teaching or research), and a lack of awareness of their own competencies. This study reveals that the inability to identify and articulate their skills and attributes makes it difficult for these graduates to match their capabilities with job requirements, and also to describe them during job interviews.

This first group of papers establishes where some of the key gaps in work-readiness lie, as viewed by both employers and recent graduates. A number of solutions are suggested including the provision of placements, building of student-industry networks, improved career advice and revisions to the curriculum. But what would motivate students to undertake a professional development program if it were available to them? Susie Ho and co-authors provide a simple answer: if they understand it will help them develop a competitive edge and secure employment! So what kinds of development programs might tertiary educators consider?

The final two papers of the volume examine examples of how an increased focus on work readiness and career planning might be embedded into the curriculum. Julia Choate and co-authors describe a structured program embedded into the Bachelor of Biomedical Science at Monash University. The five core subjects in this degree provide the opportunity to embed activities, from the first year of study, that challenge the assumptions students may have about the careers available to them. Importantly, the e-portfolio approach empowers students to continually self-assess and monitor their own skill development, raising their level of self-awareness and thereby enabling them to identify and articulate their skills and attributes.

Switching to the issues faced by PhD graduates, Susan Rowland explores the transition of highly-trained researchers into careers other than the academic positions they may have once aspired to hold. Following a summary of global investigations in this area, the message delivered is two-fold; first, that employers need to value the expertise PhD graduates bring to the workplace more than they currently do; and secondly, that educators need to move away from simply including ‘employability’ graduate attributes in the curriculum and develop ‘career-building skills’ in science students. She describes tools our students might employ, such as the Independent Development Plan, and provides a link to the free *myIDP* website developed by the American Association for the Advancement of Science. This self-paced career planning tool takes the notion of an e-portfolio to a new level. This article also poses topics of discussion including changes to university ranking metrics, the need to better articulate the broader range of careers available to science graduates, and the importance of political advocacy.

In summary, this special edition provides insights into the needs of STEM-educated graduates and their employers, an assessment of what drives students to participate in professional development programs during their tertiary study, and the ways in which improvements in self-awareness and monitoring might be embedded into the curriculum. The editorial team would like to thank the authors for contributing their research to this special issue, and inspiring the discussion and change that it will no doubt follow.
We commend these papers to you.

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