Editorial

Since STEM was first conceived in the late 1990s momentum, funds and energy have been steadily increasing in implementing integrated STEM education. Integrated STEM education refers to two or more of the discipline areas being applied in tandem, and drawing upon the 21st century competencies, to solve problems or create products. Despite the publicity and public and private funding for programs worldwide, we have to question whether STEM education is capable of achieving the outcomes that have been foisted upon it or are the expectations just too high? How can integrating science, technology, engineering and mathematics achieve the aims of international competitiveness, fiscal security, and environmental rehabilitation and protection? This Special Issue focuses on STEM Education and explores research undertaken around a wide range of educational programs that seek to promote science and mathematics education within an integrated STEM education context.

David Zandvliet's paper, 'STEM and LEAF' challenges us, by the use of metaphor and analogy, to socio-culturally critique the STEM movement as it is currently being enacted. David's ecological and environmental background comes into play as he proffers a modified ecological framework to underpin future STEM education pursuits. Given a ground swell of ecological and sustainability awareness and action engulfing Western societies in particular, a shift from an economic-political rationalist promotion of STEM education to a more authentic, responsible, and critical paradigm of science education, recognising the impact of humans upon life on Earth, may be the path for policy-makers and educators to boldly take.

The second paper in this Special Issue, 'Transdisciplinary Instruction: Implementing and Evaluating a Primary-School STEM Teaching Model', reports on a large study of students in Years 4 – 7 and endeavours to measure the effectiveness of integrated STEM lessons in engendering career interest in STEM fields. The researchers also sought to determine whether engagement in these learning episodes had any effect on the students' understanding of the work that engineers do, and thereby influence possible future career choices. This work is significant in that the data were collected from multiple sources and included two validated and widely-used surveys that provided quantitative data sets. The authors make a salient point – learning environment, attitude and understanding in a STEM context, in particular – are shaped by teachers, and so support for them to do this effectively is crucial to the success of any STEM education.

This Special Issue also examines underrepresentation in STEM fields of sub-populations and the impact of absenteeism in school STEM and non-STEM subjects upon the STEM pipeline. The third paper, 'Exploring the 'hard facts' around STEM in Australia: Females, low socioeconomic status and absenteeism' written by a collaborative research team from Monash University and the University of South Australia, presents a unique comparative analysis of female students across Years 10 – 12, in two campuses of the same school – one all-female and the other co-educational. Interestingly the authors report a 'campus effect' for both the uptake of STEM subjects and absenteeism; the all-female campus had both a higher uptake of STEM subjects and a lower absenteeism rate than the co-educational campus. Clearly, there is opportunity for further research in this area, and we hope that the team will extend their reach, and similarly report on extended findings in the future.

Whilst authentic, integrated STEM education is an aspirational goal of educators in the field, it is not an easy task, due to many complex variables at school sites. The fourth paper, 'Connecting teachers, students and pre-service teachers to improve STEM pathways in schools', reports on how a STEM Club engaged secondary school students and bridges the nexus between teaching theory learned at university and hands-on classroom experience for pre-service teachers. The project morphed into an organic Community of Practice, encompassing school students, pre-service teachers, university academics and school teachers. The power of word-of-mouth is evident in this study that reports increased interest and

activity by an increasing number of school students, who, despite giving up their 'free time', enjoyed the challenges of working on STEM projects in a collaborative and supportive environment.

The final paper, 'Transnational examination of STEM education', describes the current state-of-play and possible futures of STEM education in Australia, Indonesia, India and the United States of America. Each of these countries has its own contextual variables that impact upon the effective and scalable implementation of STEM education – be that discipline-specific or integrated across the disciplines. Differing approaches by the governments and school authorities are noted, as are rankings in international assessments (PSIA and TIMSS), and how these affect what takes place in the classroom.

Each paper in this Special Issue, posits avenues for further research and imagines ways forward in STEM education that continues to be a focus for so many Western, non-Western and developing countries across the world. We encourage readers to connect with the authoring teams to continue and expand the STEM education conversation, and in turn, strengthen positive learning outcomes for all students.

Editorial Team

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