

# HIGHER EDUCATION AND SUSTAINABLE DEVELOPMENT

A model for curriculum renewal

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## PREFACE

Society is increasingly calling for professionals to innovate and problem-solve cost-effective ways to reduce environmental pressures, now being found to pose threats to economies and societies. This poses a significant challenge to the higher education sector, requiring both capacity building for professionals and practitioners who can deal with immediate and short-term issues, along with students who will enter the workforce in the future and assist in dealing with medium- to longer-term issues.

An example of a short-term challenge is to halt the growth of greenhouse gas emissions in the near future. This would then be followed by a medium- to long-term challenge of sustaining reductions in emissions over following decades to reach stabilisation targets. Each challenge requires very different strategies. Tertiary education thus requires curriculum renewal to begin immediately and focus on both undergraduate and postgraduate/professional development programs.

Considering the complexity of capacity building in this field, we have focused on developing processes for doing so over the last decade. Experiences since 2002 have informed the development of a number of curriculum renewal aids for accelerating the process. This has included two awareness-raising textbooks on 'what is' sustainable development (*The National Advantage of Nations*, 2005; *Cents and Sustainability*, 2010), two technology-focused textbooks on 'how to' apply sustainable development principles (*Whole Systems Design*, 2008; *Factor 5*, 2009) and a number of supporting online curriculum resources (*Engineering Sustainable Solutions Program*, 2007; *Energy Transformed*, 2007; *Water Transformed*, 2011).

Further to these publications, this process-focused book focuses on 'how to' build capacity in such knowledge and skills, for the principles and practices to be embedded within daily life, as society adjusts to a low-carbon way of life. In particular, it supports our colleagues in higher education institutions seeking to bring about rapid curriculum renewal for sustainable development. By collating, synthesising and contributing to the body of knowledge on the process of embedding sustainability within higher education, we hope to reduce the barriers to curriculum renewal, and in doing so, help to build momentum for a rapid and large-scale transition. Building on experiences in engineering, we look forward to continuing our inquiry and research within other disciplines to make education for sustainability a reality in coming years.

In summary, this publication:

- Provides a summary of the unprecedented context that our generation of leaders in academia, business and government are living in;
- Highlights what is happening internationally in the education sector and implications for engineering professionals;
- Presents educators with a practical model and approach to move forward, acknowledging challenges and opportunities involved with the transition; and
- Provides professional organisations, accreditation agencies and industry with insight into the world of academia, presenting opportunities for how they can assist the transition to education for sustainable development.

## Commentary on our journey of inquiry

This book explores a case account of a sociological phenomenon, namely the need for sustainable development knowledge and skills to be embedded within curricula. In this case, our personal experiences as young engineers and early career academics suggested a shortfall in engineering education for sustainable development and subsequently an urgent need for curriculum renewal in this area.

A review of literature regarding 21st-century challenges (Chapter 1) finds strong evidence of a critical and extraordinary role for all professions to urgently help society address a multitude of emerging issues of sustainable development. The literature review also finds clear evidence of higher education institutions (HEIs) around the world facing increasing pressure from a variety of sources, including professional bodies, industry, government and prospective students, to urgently equip graduates with knowledge and skills to address such challenges. Furthermore, we observe a time lag dilemma for the higher education sector, particularly in engineering education, whereby the timeframe for producing graduates with the required knowledge and skills lags behind the demand for graduates with such knowledge and skills – and indeed the timeframe within which the profession is expected to have acquired this increased capability. This was also evidenced in the findings of several key international surveys over the last decade, as outlined herein.

A variety of catalysts or ‘drivers’ for accelerated curriculum renewal are identified (Chapter 2), from which we conclude that a focus on engineering education and sustainable development is appropriate, with future potential application to a variety of other disciplines facing similar urgent and challenging circumstances. It is also concluded that although there is evidence of frustration with the current ‘slow’ process, in the absence of documented discourse about dealing with potential time constraints there has been little discussion of alternative strategies for curriculum renewal in this area. Despite discussion about timing issues existing for more than four decades, there has been little consideration for the speed at which curriculum is constructed and implemented or reviewed. While existing models provide significant guidance on systematic curriculum construction, none consider – either explicitly or implicitly – how to vary the pace at which curriculum renewal may be undertaken.

Through exploring documented cases of curriculum renewal and through personal experiences in various research projects, a number of mechanisms are identified that could be grouped under a number of themes or ‘elements’ of curriculum renewal (Chapter 3, Chapters 6–9 and Chapter 11), resulting in a curriculum renewal model coupled with an organisational change model, extending the discourse on ‘curriculum in context’.

It is also concluded that a number of catalysts play a critical role in ensuring timely curriculum renewal beyond faculty and units within the larger institution (Chapter 4). We discuss an existing schematic for an organisational change model that could be adapted to provide a schematic for the model for rapid curriculum renewal. Not only does this model provide the sense of non-linear dynamism necessary within the higher education industry, it also demonstrates the non-linear behaviour of the elements of curriculum renewal, intertwining in a complex pathway, which is highly dependent on the organisational structure and context, but moving towards the goal of rapid curriculum renewal.

There are also several important strategic considerations to address a number of identified barriers to the process, taking a holistic, non-linear and integrated approach to using the elements (Chapter 5). Ultimately, institutional leadership and support is also critical in ensuring that an institution adopts a process of rapid curriculum renewal, setting and meeting the planned milestones (Chapter 10).

## Opportunities for future research

This book is based on the premise that issues of sustainability and the contributing role of the professions are both critical. Furthermore, we believe that the education of professionals to address these issues is a pressing world-wide problem. With the future well-being of society in mind, our approach can be considered by educators world-wide as a potential way forward to achieve rapid curriculum renewal. Furthering our exploration within this book, a number of additional research opportunities are highlighted here:

- Trialling the curriculum renewal model and organisational change model: through action-based research and reflection by others on curriculum renewal experiences.
- Investigating the role of accreditation in driving rapid curriculum renewal: furthering discussion on the role of accreditation as a potential major catalyst for rapid curriculum renewal.
- Investigating supporting government policy mechanisms: considering the potential for national guidance to also contribute to rapid curriculum renewal, including policy mechanisms and other leverage opportunities.
- Further enhancing the theory associated with models: involving consideration of how these complement and challenge existing philosophical constructs of curriculum renewal.

This publication builds on the topic of education for sustainable development within engineering education. However, there are many other professions (for example, including law, business, nursing and medicine) and sectors of society (for example, schools and vocational education) facing similar pressure to incorporate emerging knowledge and skills related to sustainable development. The potential for wide-scale application is also apparent when considering that there are around 60 million teachers in the world spanning kindergarten through to higher education, and the majority have been trained through the higher education system:<sup>1</sup>

- Investigating the applicability of the models to other disciplines and cultural contexts: exploring the concept of rapid curriculum renewal in higher education, transcending boundaries between disciplines and continents.
- Investigating the applicability of the model and helix to K–12 providers: from kindergarten to senior high school (i.e. K–12) education providers, where the professional development of teachers in education for sustainability has been identified as ‘the priority of priorities’.<sup>2</sup>

- Investigating the applicability of the models to other further education providers: alongside professional education, technical and vocational education and training providers are also grappling with the significant challenge of embedding sustainability knowledge and skills within their programs, as highlighted by the NSW Department of Education and Training in their 2009 report *Skills for Sustainability*.<sup>3</sup>

## Sustaining and building communities of practice

This publication focuses on curriculum that is heavily regulated and which undergoes incremental change as a long-term 'evolutionary' – rather than short-term 'revolutionary' – timescale. Moreover, rapid curriculum renewal is as much about process as it is content related. Hence, it is anticipated that the approaches we discuss here will be useful wherever there is an imperative for urgent change regarding any new knowledge and skills that are complex, not just the 21st-century challenges discussed in this publication. Within this context, a dynamic and responsive curriculum relies on sustaining the enthusiasm of educators exploring curriculum renewal and further building this community amongst our 60 million colleagues globally. The goal of 'education for sustainable development' provides an immediate focus for such efforts that is urgent and challenging for everyone to engage with.

There are so many questions within the realm of timely curriculum renewal that could drive collaboration, inquiry and action – a lifetime's endeavour for many! There is the potential for curriculum-related research initiatives underway to consider the implications of rapid curriculum renewal, investigating how to systematically achieve a rapid process of integration. Any aspect of this publication could be further explored through action-research, expanding the conversation. For example, there is not yet a significant literature that auditing a program will lead to curriculum renewal or changed graduate capabilities. To rigorously demonstrate this could involve a significant longitudinal behaviour change research project comprising a number of schools internationally, including those who have decided to proceed with the transition (i.e. the trial group) and others who have decided not to (i.e. the control group). The trial group could undertake an audit of one or more programs, and then track curriculum modifications and the capabilities of graduates against a pre-determined set of 'graduate attributes' through subsequent audits. We look forward to hearing from colleagues who may be interested in such enquiry.

## Notes

- 1 United Nations Educational Scientific and Cultural Organisation (UNESCO) (2002) *Education for Sustainability – From Rio to Johannesburg: Lessons learnt from a decade of commitment*.
- 2 UNESCO-UNEP (1990) 'Environmentally educated teachers: The priority of priorities', *Connect* Vol XV, No 1, pp1–3.
- 3 NSW Board of Vocational Education and Training (2009) *Skills for Sustainability*, 2nd ed, NSW Department of Education and Training, Sydney.