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Transformative learning: innovating sustainability education in built environment

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# Transformative learning: innovating sustainability education in built environment

Transformative  
learning

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## Abstract

**Purpose** – This paper aims to evaluate how transformative learning is key to innovating sustainability education in the built environment in the region's universities, in addition to reporting on the research project undertaken to integrate sustainability thinking and practice into engineering/built environment curricula in Asia-Pacific universities.

**Design/methodology/approach** – The project drew from the experiences of academics in built environment programmes and espoused a collaborative inquiry process wherein the role of the industry was vital. A literature review focusing on sustainability integration into curricula was followed by a workshop which brought together academic and industry participants.

**Findings** – The general direction of education for sustainability is moving increasingly towards integration and innovation. However, the slow progress of integration of sustainability in the built environment curricula may have been due in part to the outcome/practice-led approach of built environment education, which is the hallmark of the discipline and lends to a largely discipline-based curriculum framework.

**Research limitations/implications** – The project focused only on the curricula of university programmes and courses taught in the participating Asia-Pacific universities and institutions.

**Practical implications** – This paper highlights how the framework for the proposed curriculum guide focusing primarily on built environment programmes and courses can provide guidance for potential application in other higher education institutions.

**Originality/value** – Much is written about embedding sustainability and education in built environment curricula. However, little analysis, application and collaborative work in Asia-Pacific universities have taken place. This paper considers the value of transformative learning in the innovation of the predominantly discipline-based engineering/built environment programmes for sustainability.

**Keywords** Transformative learning, Curricula, Higher education, Asia-Pacific, Built environment education, Sustainability education

**Paper type** Research paper

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**Introduction: sustainability education in the built environment**

The further and higher education sector has acknowledged the importance of learning for sustainability through various declarations (Centre for Environment Education, 2007; UNESCO – Education Sector, 2006; University Leaders for a Sustainable Future [ULSF], 1990), including committing universities to curriculum change and professional development for sustainability (University Leaders for a Sustainable Future [ULSF], 1990).

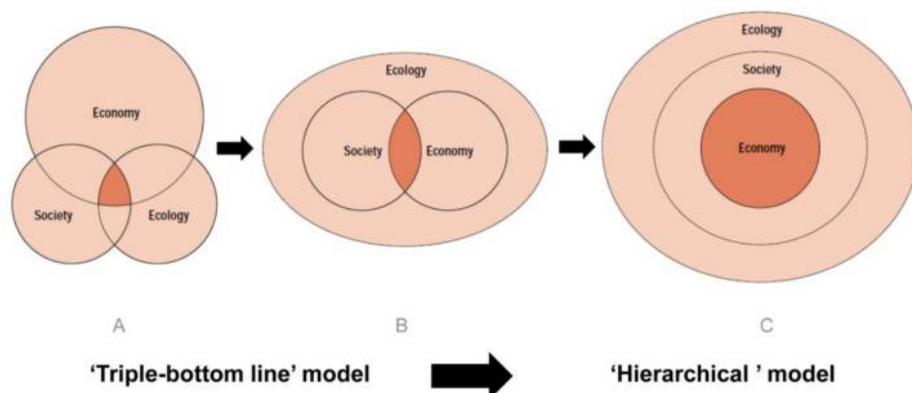
In Australia, education for sustainability has evolved over the past 30 years, where the focus has shifted from knowledge of natural ecosystems to equipping people with the knowledge, skills and understanding necessary to make decisions based on environmental, social and economic implications (ARIES, 2009; Tilbury and Cooke, 2005b). Sustainability education initiatives from Australia and New Zealand have been widely published (Sherren, 2006; Sterling, 2004b; Thomas and Nicita, 2002; Tilbury, 2004; Tilbury and Cooke, 2005a; Tilbury and Cooke, 2005b). Developments from other regions have received less consideration (Ryan *et al.*, 2010). Curriculum change is needed across all programmes of study (Tilbury and Cooke, 2005a, p. 19), if lasting changes recognising sustainability imperatives are to be achieved.

In the Asia-Pacific region, the demand for higher education has risen in tandem with overall population growth and increasing affluence, which adds urgency to the pursuit of sustainability (World Bank, 2012). Education for sustainability has been dealt with along several fronts: government policies and agencies (Ryan *et al.*, 2010), international initiatives and drives such as the Promotion of Sustainability in Postgraduate Education and Research Network (ProSPER.Net) and the Regional Centres of Expertise in ecologically/environmentally sustainable development (ESD), both developed by the United Nations University's Institute of Advanced Studies. In addition, the United Nations Environment Programme (UNEP) Asia-Pacific Regional University Consortium initiated by UNEP's Regional Office for Asia and the Pacific (Nomura and Abe, 2011; UNU-IAS, 2013) has also set a clear direction for sustainability in the built environment.

*Sustainability knowledge as the underpinning guiding principle*

Sustainability has been defined in many different ways. The popular and often quoted definition of sustainability is from the 1987 Report of the World Commission on Environment and Development (1987), "Our Common Future". Put simply, sustainability refers to human society being capable of continuing indefinitely. The development that will move our society in that direction is what we call sustainable development. However, the concept of sustainability becomes relevant only when we understand the *un-sustainability* inherent in the current activities of society. "Sustainability is a term that arises in response to a potential environmental and human disaster ... and cannot be separated from that other great concept ... *globalization*" (Cullingford, 2004, p. 19).

Predominant models of sustainability include the "triple bottom line", coined by Elkington (1997), in which the environmental, social and financial outcomes are taken into account (Model A, Figure 1). Sustainability thinking (Lowe, 1996) has been expanded further to include further variants to this model, characterised by a piecemeal approach to ESD (Model B, Figure 1) and as nesting systems, where sustainability



**Figure 1.**  
Framework for sustainability and its transition

**Source:** Image adapted from Lowe (1996)

requires integration of ecological thinking into all social and economic planning (Model C, Figure 1).

Other definitions and approaches include a systems perspective – where sustainability exists when none of the system elements are overloaded (Brown, 2003). An ecosystem perspective to sustainability considers sustainability to be the “capacity to create, test, and maintain adaptive capability” (Holling, 2004). Holling and Gunderson’s (2002) *panarchy framework* outlines a “theory of adaptive change” that draws on ecological theory to develop principles for sound human ecological relationships. The central tenet of this theory is the ability to adapt to change, which is conceptualised through the adaptive renewal cycle.

Miller *et al.* (2011) contend that building sustainability knowledge requires a fundamentally different approach to the ways academic institutions organise education and research and relate to society. *Sustainability knowledge* is defined as knowledge that (Miller *et al.*, 2011, p. 179):

- recognises the complexity of system dynamics;
- is socially robust;
- is acknowledged by multiple epistemic cultures; and
- incorporates (contextualised) normative criteria.

### *Educational responses*

Since the 1970s, environmental education and its transition to sustainability education has developed a reasonably clear view of what it is aiming to achieve, and material and information are available to support educators (GUNI, 2011; Sanusi *et al.*, 2011; Thomas *et al.*, 1999; Tilbury and Cooke, 2005b). The underpinning frameworks of sustainability knowledge show that elements of sustainability (including problems) could fit comfortably into the different disciplinary approaches such as those of ecology, physics, chemistry, geography, history, sociology, government and economics (Miller *et al.*, 2011).

In defining education for sustainability, Thomas (2004) suggests that, as identified by Dyer (1996) and Woods (1994), the broad pedagogical models for the incorporation of

sustainability, particularly where the environmental focus of sustainability has been determined, are as follows (Thomas, 2004, p. 35):

- the inclusion of the coverage of some environment (sustainability) issues and material in an existing course of the programme;
- having a separate course that deals specifically with environmental matters; and
- integrating environmental (sustainability) issues and discussion into all courses so that environmental (sustainability) understanding is developed in the context of the discipline, the programme and the course material.

However, Fenner *et al.* (2005) argue that to successfully introduce sustainability concepts into engineering courses and curricula, educators must understand the process of change. “Capacity building of educators” is considered to be the cornerstone of transforming universities to become effective in empowering students to become change agents for sustainability (Lozano-García *et al.*, 2008).

### **The ProSPER.Net project for Asia-Pacific universities**

The ProSPER.Net project, *Integrating sustainability education into engineering and built environment curriculum*, was led by academics from an Australian university. It followed a collaborative inquiry process wherein the role of the industry to achieve outcomes was considered as vital as ensuring the sustainability goals of project. The central objectives of the ProSPER.Net Project were to:

- integrate sustainability thinking and practice into engineering and built environment curricula through a professional development programme for university academics;
- identify key priorities for inclusion in the professional development programme;
- contextualise the priorities within global and local policy commitments for sustainability in the built environment; and
- develop a framework for a curriculum guide for university academics and curriculum developers in built environment disciplines such as engineering and architecture at undergraduate and postgraduate levels.

Further information on this ProSPER.Net research project is available in the academic network’s publications (UNU-IAS, 2013, pp. 28-33).

A regional approach, taking international, national, local and sub-regional concerns in relation to sustainability teaching and learning, and expectations of both graduates and the industry, was undertaken. A review of literature formed the background work for the project. This included desktop research and laying the foundation for the workshop, followed by discussions and insightful inputs from the participating universities and institutions to understand the current programmes and course offerings in the built environment curricula.

The literature review focused on understanding the elements of sustainability currently being integrated into curricula, both from programme level and course development perspectives by the participant universities. The desktop investigation also canvassed the academic training and professional development of built environment practitioners in sustainability education. To ensure curriculum of participant universities was interpreted appropriately and considered regional

differences, participants were invited to a workshop, where they had the opportunity to engage with industry professionals dealing with sustainability concerns in their day-to-day work. To develop a guide for university academics, it was essential that the invited participants from academia and industry had the opportunity to develop together the key requirements of curricula embedding and integrating sustainability thought and practice.

Thus, the core activity of the ProSPER.Net project was a three-day workshop held in Ho Chi Minh City, Vietnam, which brought together the participants and shared knowledge and experiences to recommend practical approaches for integrating sustainability issues while understanding the theoretical dimensions of sustainability and sharing experiences about what approaches best work for all stakeholders. The colloquium contextualised the current state of sustainability integration in the existing built environment curricula in the Asia-Pacific region and established opportunities for networking and building close links within academia and the industry.

Nine teaching academics from universities in the Asia-Pacific region and five industry and government representatives participated in the project and the workshop. The academics were invited by the ProSPER.Net Board and their representatives. A core group of three universities were identified by the ProSPER.Net Board, and the remaining universities and industry representatives expected to benefit from attendance to the workshop and the broader outcomes of the project were selected through discussions with the Board. The aim was to select a mix of universities from the Asia-Pacific region where most growth in the building and construction sector is expected to occur, with attendant growth in population. The invited industry participants were selected from a mix of international and Vietnamese national participants, as the workshop was held in Vietnam.

To achieve the objectives of the research project, an action research framework was adopted. The workshop functioned as a participatory action research process, whereby progressive problem-solving (in this case, curriculum development) occurred with participants working with others in teams or as part of a “community of practice” to improve the way they address issues and solve problems. Using participatory action research (Argyris, 1993), the workshop identified how best to integrate sustainability thinking and practice into curricula. In collaboration with the industry practitioners, it identified the key priorities for inclusion, within global and local policy commitments.

The final workshop programme was kept flexible to take account of specific needs of the workshop participants and planning of events leading to the workshop. Action research approach for the workshop demands that planning, processes and delivery need to change to maximise outcomes. The workshop structure was designed such that there was a clear link between the various segments leading to the outcomes. Feedback was sought after each main segment of the workshop. The feedback was collected using a feedback form over the three days of the workshop. Using informal feedback from the participants during the workshop and reviewing formal feedback provided in the feedback forms, the workshop facilitator was able to adjust the workshop content over the three days to maximise outcomes. This ensured that the framework of action research was implemented in practice.

To understand participant’s approaches and levels of sustainability integration, information provided by participants formed part of the desktop literature review and

underpinned the framework of the workshop. It demonstrated the need for the definition and resolution of the issues identified in the literature review on:

- curriculum design and structure;
- capacity-building for academics in transforming sustainability knowledge;
- learning outcomes – student experiences;
- sustainability pedagogies;
- pedagogical implications in the engineering and built environment disciplines;
- industry input – students as employable graduates; and
- challenges to professionals in the field of built environment, their institutional structures and boundaries.

These are discussed briefly in the following sections.

### **Innovation of education and integration of sustainability**

The unique features and issues of sustainability have a profound effect on the way academic curricula are structured (Lozano-Garcia *et al.*, 2008), not just as knowledge sharing or transfer, but as knowledge generation (Miller *et al.*, 2011) at all levels. It also needs to consider not just for teaching and learning but also across the university or educational institution, adaptive to changing societal needs and co-produce with society the knowledge for sustainability. It needs to espouse “walking the talk” at all levels of university teaching and operations.

There have been a growing number of studies on how to integrate sustainability in higher education, and broad and general frameworks for its integration into curricula have been presented:

- an incremental approach whereby small groups can start out and, if successful, can be expanded throughout the university (Lozano, 2006);
- the need to think strategically about integrating sustainability into higher education (Lidgren *et al.*, 2006; Scott and Gough, 2006); and
- the need for a broad and general approach (Sammalisto and Lindhqvist, 2008).

The literature indicates that many core principles of integrating sustainability into higher education require substantial shifts in thinking and practice, some of which may be out of the reach of the individual lecturer and more challenging for some disciplines than others. Sterling (2004a, 2011) argues that sustainability education implies a transformation in educational thinking and practice through which education becomes more *transformative learning*. This indicates a paradigm that is holistic, systemic and participative.

#### *Towards transformative learning*

To foster environmental literacy and build awareness of sustainability issues, the predominant trend in higher education curriculum has largely been towards learning *about* sustainability (Benn, 1999; Page, 2009). *Education about sustainability* focuses on developing key knowledge and understanding about natural systems and environmental issues as opposed to learning that engages and equips for change towards sustainability (Tilbury, 2004). *Learning for sustainability* moves beyond

education *in* and *about* the environment to focus on equipping students with the conceptual frameworks necessary to develop skills to effectively enact change towards sustainability (Tilbury and Cooke, 2005a, 2005b).

Addressing sustainability in the curriculum requires more than the addition of content (Sterling and Thomas, 2006; Tilbury and Cooke, 2005a). The approach should espouse an:

[...] emphasis on contextualised knowledge; different ways of knowing (in addition to scientific approaches); real-world local issues as a focus of learning; the active role of the learner; and the need for participatory methodology (Sterling, 2004a, p. 54).

The focus should be as a wholly integrative approach, where sustainability is seen as a context for delivering the aims of education and not as a competing priority (UNESCO – Asia and Pacific Regional Bureau for Education, 2005, p. 9). Sterling (2004b) suggested that the significant learning challenge of higher education in the transition towards a more sustainable society is not just in terms of *student learning* (“designed learning” as a result of curricula and pedagogy) but also learning within the wider community including senior management, academics and support staff (“attendant learning”). Fien *et al.* (2000) contend that “teacher education” or professional development for educators is an especially important area of action in the reorientation of education towards sustainability where reforms would require new attitudes and skills among teachers. Sterling and Thomas (2006) and Sterling (2004b) further illustrated a model of staged learning responses to sustainability from the perspectives of societal change and educational change (Table I). It is in the fourth level that the defining transformation takes place where real-life issues are dealt with on a case-by-case basis, taking an integrative, participative approach.

Sterling (2004a, pp. 57-58) provided a concise summary of what is sustainability knowledge and thus sustainability education, where it demonstrates resonance with the adaptive cycle (panarchy) framework (Holling *et al.*, 2002). Among others, sustainability implies embedding, embodying and exploring the nature of sustainability as intrinsic to the *learning process*. This is education “as” sustainability – nurturing *critical, systemic and reflective thinking; creativity; self-organisation; and adaptive management* – rather than education “about” sustainability or education “for” particular sustainable development outcomes. Sustainability is not prescriptive, but *indicative and purposeful*.

No.	Sustainability transition	Response	State of sustainability (societal change)	State of education (educational change)
1	Very weak	Denial, rejection or minimum change	No change (or token)	No change (or token)
2	Weak	“Bolt-on”	Cosmetic reform	Education <i>about</i> sustainability
3	Strong	“Build-in”	Serious greening	Education <i>for</i> sustainability
4	Very strong	Rebuild or redesign	Wholly integrative	Sustainable education

**Table I.**  
Levels of social and education responses to sustainability

Source: Sterling and Thomas (2006, Table II, p. 355)

Sustainability is based on “systemics” rather than “systematics” – that is, the *emphasis is on systemic learning as change*, rather than *systematic control* in response to change.

Echoing the necessity for “capacity building for educators” (Lozano-García *et al.*, 2008), the change of educational culture requires a deep learning process by educational actors. If higher education institutions are to play a constructive part in the transformation of sustainability knowledge and transition of sustainable education to provide transformative learning experiences, these institutions and educators need to go through a transformative learning experience themselves (Blewitt, 2004; Osmond *et al.*, 2013; Sterling, 2004a, 2011).

*Sustainability pedagogies*

Based on the prioritised expectations on the learning outcomes and the marketplace requirements for built environment graduate attributes discussed in the ProSPER.Net workshop, the ideas and suggestions for the integration of sustainability into the curricula (Table II) interestingly echoed those approaches and models outlined by Thomas *et al.* (1999) and Thomas and Nicita (2002). Furthermore, drawing from the workshop discussions and insights offered by both the teaching academics and industry representatives, to address and effect targeted learning outcomes, it was imperative that multiple approaches be used.

*Learning outcomes*

Learning outcomes are the point at which education principles and other principles meet (Thomas *et al.*, 1999) and these are the pivotal links between teaching intentions and the assessment of student learning (Biggs and Tang, 2011). As the literature review for this project uncovered, the workshop discussions similarly revealed that sustainability pedagogies are rife with the need for the different approaches to teaching and navigating the difficult transformative changes to higher education curricula. There is,

**Table II.**  
Requirements for changes to built environment curriculum (ProSPER.Net workshop)

Required development and changes to built environment curriculum	
How educators will make the change	How to engage industry
Change teaching content	Continuing professional education
Research collaboration	Open lectures/seminars open to all in the university rather than just within the programme
Sharing/networking lessons learned	Research collaboration
Best practice examples/case studies used where possible	Form partnerships: students and industry through conferences such as with Green Building Councils, etc.
Dialogue/discussions with industry	Getting industry speakers
Invite industry to: student presentations, faculty presentations	Accreditation considerations
Dialogue/discussions with other university staff/officials	Organise activities with industry (e.g. conferences, seminars, etc.)
Keep looking for funding	Send graduates to individual companies
Lobbying politicians	Mentoring
	Alumni tracking – surveys
	Advisory boards
	Adjunct professors
	Feel-good stories/testaments

however, limited parallel discussion on the learning outcomes associated with these different approaches (Fenner *et al.*, 2005; Hopkinson and James, 2010), although Thomas *et al.* (1999) have provided some insights.

In the ProSPER.Net workshop, discussion on what would be the educational responses and what should be the focus of a curriculum in the built environment that espouses sustainability education, the academic and industry participants outlined their expectations on the learning outcomes and anticipated attributes of graduates (Table III). For the learning outcomes that weighed heavily for the academics, it was interesting to note that while professional competence was considered to be important, so also were softer skills. This is aligned to trends observed in Australia (Iyer-Raniga *et al.*, 2010; Sterling and Thomas, 2006; Thomas and Nicita, 2002). From the expectations of what industry has identified as key needs and attributes of the graduates who would address the requirements of the marketplace, the responses show that learning outcomes are not all about professional competence.

Parker *et al.* (2004) identified three categories of capabilities as being requirements of education for sustainability (Table IV), aligned with findings by Sterling and Thomas (2006). These capability requirements resonate well with the academics' expectations on the learning outcomes and anticipated attributes of graduates and correlate with industry requirements (Table IV).

*Challenges and barriers*

Educators must understand the process of change to successfully introduce sustainability concepts into course and curricula (Fenner *et al.*, 2005). The typical

No.	Learning outcomes and anticipated attributes	
	From academics	From industry
1	Genuine concern	Motivation to make change
2	Discipline/competence/ sustainability	Life-cycle thinking
3	Good team player	Open to other disciplines
4	Right attitude	Environmental/social/economic implications of their work

**Table III.**  
Learning outcomes and anticipated student attributes (ProSPER.Net workshop)

Knowledge and understanding of	Skills in	Values and attitudes
Social justice and equity	Critical thinking	Sense of identity and self-esteem
Diversity	Ability to argue effectively	Commitment to social justice and equity
Globalisation and interdependence	Ability to challenge injustice and inequalities	Value and respect for diversity
Sustainable development	Respect for people and things	Concern for environment and commitment to sustainable development
Peace and conflict	Cooperation and conflict resolution	Belief that people can make a difference

**Table IV.**  
Capability requirements for education for sustainability

Source: Parker *et al.* (2004) cited in Sterling and Thomas (2006, Table V, p. 361)

barriers to incorporating sustainability in any organisation, such as a university, are presented by [Lozano \(2006\)](#) and highlight the notion that “capacity building of educators” must then be considered to be the cornerstone of transforming universities to become effective in empowering students to become change agents for sustainability ([Lozano-García et al., 2008](#)).

The workshop discussions on the extensive and diverse programmes and courses taught in the participating institutions revealed that the issues, challenges and barriers for implementation in sustainability education were similarly not divergent among the different programmes and courses. These issues, challenges and difficulties in the educational responses to change in sustainability education are summarised in the rigidity of institutional structures, people and disciplines and in the lack of facilities and resources, and perception or lack of empowerment to make changes. The academics advocated strongly the following ([Table V](#)) to further explore the insights and address the key messages discussed in the workshop.

*Curriculum design: interdisciplinary versus discipline-based*

By its nature, the many interrelated dimensions of sustainability defy containment and easy compartmentalisation into disciplinary silos ([Selby, 2006](#)). *Interdisciplinarity* is any approach that goes beyond a single discipline and the logic of interdisciplinary approaches to sustainability issues derives from the consensus that these issues cannot be sufficiently understood in isolation ([Blewitt and Cullingford, 2004](#); [Parker, 2010](#); [Tilbury, 2004](#)). [Jones et al. \(2010a\)](#) define interdisciplinarity as disciplines working collaboratively by sharing their insights and methods in an attempt to go beyond their own boundaries to address issues or questions. On the other hand, *multidisciplinarity* is largely recognised in the literature as being the least integrated form of

Information	Resources	Implementation and review
What is the state of sustainability education in ProSPER.Net member institutions and beyond (wider community) Organise forum for industry/ academics/stakeholders to understand the best practice/ case study examples; online chat forums, etc. Establish a repository of best practice models Survey of industry in countries to examine what is required in research and education Build close relationship with research and education, and continuously close feedback loops	Textbooks for learning modules on sustainability education Resources for teaching need to be development both in breadth and depth Detailed curriculum development Support at high level of university for promotion of innovativeness in curriculum, for example, meeting senior management at the university such as the Vice-Chancellor, Rector, etc.	Monitoring (medium- and long-term) Follow-up with students' post-graduation to determine whether concepts are applicable in industry and whether learning media are appropriate

**Table V.** Issues and challenges (ProSPER.Net workshop)

interdisciplinarity, where “disciplines might work together cooperatively but without sharing ideas, assumptions and methodologies and without being influenced or changed by the other” (Jones *et al.*, 2010a, p. 24).

Jones *et al.* (2010b) explored the relationship between sustainability and interdisciplinarity and suggest that sustainability has primarily ontological dimensions and normative dimensions, where sustainability presents an overarching and complex socioeconomic-ecological context, wherein interdisciplinarity – as a holistic mode of understanding, organisation of knowledge and inquiry – seems appropriate (Jones *et al.*, 2010a, p. 19).

### *Development and framework of built environment sustainability education curriculum guide*

Informed by the literature review and the workshop outcomes, the formulation of the framework of the proposed curriculum guide drew on seminal and foundational reports and key text references (CIB, 1999; du Plessis, 2002; Graham and Booth, 2010; Lyth *et al.*, 2007) which focus primarily on the built environment and construction sector and point to sustainability education in the built environment. The curriculum guide is available in the ProSPER.Net academic network publications (Tanaka and Tabucanon, 2014, pp. 56-87).

The proposed guide for university academics and curriculum developers in the built environment disciplines emphasises the process of integrating sustainability thinking and practice into the built environment curricula and the key role the professions play in the creation of sustainable built environments. Embedding and embodying sustainability is intrinsic and wholly integrative to the learning process. The iterative and continual learning process is described in Figure 2 and hinges on addressing the key challenge of building sustainability progress on the local and regional contexts and the academic strengths of particular higher education institutions (Ryan *et al.*, 2010), rather than on generic approaches. This approach has also been reflected in the UNEP Greening Universities Toolkit (Osmond *et al.*, 2013).

To assist curriculum developers and academics, the proposed guide is structured in four sections with a view of facilitating rather than directing change in an interactive format to capture feedback and experiences. The first section outlines the priorities and strategies for capacity-building and contextualises professional development for educators, and the second section provides guiding principles for teaching and learning issues, identifying learning aims and developing learning outcomes; transformative sustainability approaches and methods; repository of references and useful resources; presentation of best practice and case study example; and monitoring and closing of feedback loops. A template of programme, and curriculum content, sustainability pedagogies for built environment courses and references and useful resources are provided in the third section. The fourth and final section outlines the available knowledge networks for faculty development and provides a platform for curriculum dissemination and distribution, reporting and monitoring of progress and evaluation.

A key finding of this ProSPER.Net research project sets the direction on having curriculum reform taking place in the context of the existing broader built environment stakeholders – industry, professional and government interests. This places challenges for academia in general, as it highlights the importance of the necessity for industry

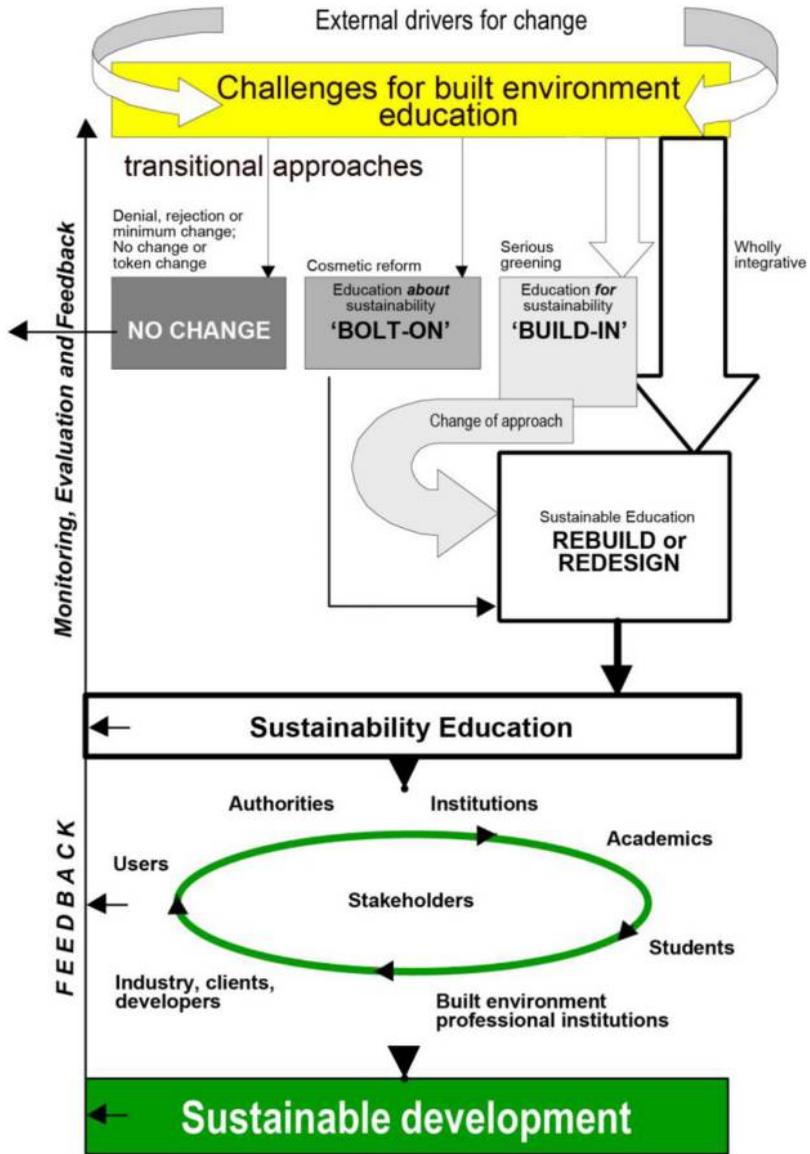


Figure 2.  
Learning process to  
sustainability  
education

Source: Adapted from Strategies and Actions for Sustainable Construction CIB (1999, p. 21)

collaboration to address the reality and challenges built environment graduates face now and in the future.

As part of the development of the proposed guide and with the aim of facilitating further collaborations and discussions with the project participants (both the academics

and industry representatives), ProSPER.Net has assisted in providing a platform for the online discussion via the project website: “Engineering and Built Environment Curriculum” (available during the duration of the project).

### Conclusions: directions and imperatives

In this carbon-constrained climate, now more than ever, the approach taken for sustainability education needs to move from traditional ways of thinking and doing to actions that provide a clear direction for the future.

The diverse experiences of the academics and industry representatives in the ProSPER.Net workshop point to these issues, which are key to professional education for sustainability:

- pedagogical implications in the built environment discipline – transformative learning;
- learning outcomes – student experiences;
- interdisciplinary rather than discipline based;
- industry input – students with attributes as employable graduates; and
- challenges to the professionals in the field of the built environment, their institutional structures and their boundaries.

To successfully introduce sustainability concepts into course and curricula, educators must understand the process of change (Fenner *et al.*, 2005), and “capacity building of educators” must then be considered the cornerstone of transforming universities to become effective in empowering students to become change agents for sustainability (Lozano-García *et al.*, 2008). This project was a modest effort to seek academic and industry collaboration in integrating sustainability thinking and practice to existing built environment curricula in the Asia-Pacific region. The main outcome envisaged at the commencement of the project was that the participants would understand the value of sustainability integration and seek to make changes in their curriculum. The findings of this project will be used to progress into the next phase wherein a case-study country within the region will be identified. The country will develop a substantive curriculum change project for one of the diverse professions comprising the built environment discipline. This potential case study may then be used to develop a community or network of practice for roll out in other countries in the Asia-Pacific region, and indeed across emerging economies. This next phase of the project will involve the potential application and trial of the guide in context, which would allow development of resources, implementation, monitoring and evaluation.

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