
Critical Thinking, Transformative Learning, Sustainable Education, and Problem-Based Learning in Universities

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Abstract

In universities, the need for education associated with sustainability is widely accepted and it is increasingly being introduced. However, the associated concepts and terms are contested—*education for sustainable development* and *education for sustainability* represent increasing levels of change required in curricula, while achieving *sustainable education* will require even greater change. A transformative pedagogy underlies and contributes to the extent of the change, as more argue for a range of analytical and context-related skills to be developed in students. To operationalize education associated with sustainability, teaching approaches must focus on elements relating to the processes of learning, rather than the accumulation of knowledge—to develop graduates with capabilities to improvise, adapt, innovate, and be creative. Skills such as interdisciplinary thinking, problem solving, team working, and holistic thinking are often mentioned. These skills are encompassed by the pedagogy of problem-based learning (PBL), which provides students with opportunities to learn to think, specifically “*how to think*” rather than “*what to think*,” and potentially within the framework of sustainability. Consequently, it is important to identify the commonalities of transformative learning, sustainable education and PBL. A key link here is critical thinking, and the challenge is to transform our pedagogy

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across all disciplines to have academics and students thinking critically. This article elaborates on these points and argues that the development of thinking is the critical element in education related to sustainability.

Keywords

critical thinking, problem-based learning, sustainability, sustainable education, transformative learning

An Evolution: From Environmental Education to Education for Sustainability

The 1978 UNESCO conference in Tbilisi formalized the concept of Environmental Education,¹ where the emphasis was on developing an understanding of various impacts on the biophysical environment (Day & Monroe, 2000). In response, universities have initiated curricula to support the development of related capabilities in some graduates. Under the direction of Agenda 21, the work of the UNESCO Educating for a Sustainable Future program in the 1990s, the declaration of a UN Decade of Education for Sustainable Development (2005-2014), and the movement to “green universities,” the focus of environmental education has broadened to encompass the wider agenda of education for sustainable development (ESD; Global Development Research Centre, 2005).²

Since the Tbilisi conference, we have seen an evolution in education associated with the environment. Although the earlier environmental education often focused on developing knowledge *about* the environment, for some educators there was also an element of values (i.e., favoring the environment) to be included, leading to education *for* the environment. In the 1980s, the political undertones of including environmental values in curriculum had the potential to be a liberating concept that transformed the thinking of both teachers and students. Subsequently, the addition of social and economic considerations to those of the environment expanded the concepts of this educational field, but the tendency has still been to focus on knowledge. As discussed in the following section, the evolution has not stopped at the development of knowledge. More recent developments have moved the focus onto education for sustainability (EfS), with its promotion of understanding the need for supporting sustainable lifestyles. As such, EfS is a developing example of transformative education.

The Need for Sustainable Education

Current global trends suggest that our behaviors threaten our ability “to meet the needs of the present generation without compromising the ability of future generations to meet their own needs” (Brundtland, 1987, p. 8). As a consequence, since the early 1990s, there have been many calls for universities to offer ESD as one way of

The following are examples from the international and Australian contexts:

- The 1992 United Nations Conference on Environment and Development in Rio de Janeiro adopted Agenda 21, in which Chapter 36, “Promoting Education, Public Awareness and Training”, includes universities in education for sustainability (International Institute for Sustainable Development, 2005)
- The focus of the United Nations Decade of Education for Sustainable Development is to have all educators include sustainable development concerns and goals in their own curricula (UNESCO, 2004).
- Several declarations by the international university community, such as the well-known Talloires Declaration, commit their signatories to build sustainability actions into operations and curricula (of the nearly 420 signatories, currently 17 are Australian universities) (ULSF, 2010)
- Some specific initiatives of government-associated bodies guide universities to adopt curricula and operational approaches to support sustainable development (e.g. Higher Education Funding Council for England, 2009)
- In Australia, the national government has strategies for sustainable development, such as the “Environmental Education for a Sustainable Future: National Action Plan”, which identifies universities’ role in sustainability education (Environment Australia, 2000)
- Also in Australia, there are specific initiatives by national organizations, for example the Australian Vice-Chancellor’s Committee, which encourages its members to:
- “build capacity in the community by educating the next generation of professionals and leaders to become fully aware of sustainability:
 - for students, consider embedding elements of sustainability at appropriate levels in academic programs;
 - for staff, consider implementing Professional Development programs on sustainability themes” (AVCC, 2006, n.p.).

Figure 1. Examples of declarations of the need for education for sustainable development in universities.

minimizing the disconnection between humans and the natural environment (see Figure 1). Internationally, through conferences, publications, and statements of commitment, there have been increasing moves toward the inclusion of environmental and sustainability issues in tertiary curricula (Thomas, 2004).

There are many contentious issues on the path to sustainability. One is how much change is required in university curricula to accommodate EfS and sustainable education (SE). Sterling and Thomas (2006) suggest there are four stages that universities would move through (see Figure 2). The degree of change required to achieve “sustainable education” is enormous; as de la Harpe and Thomas (2009) indicate, any curriculum change related to sustainability faces many barriers. To overcome these we build on the “bolt-on” approach of ESD (which requires minimal change to curricula in universities) to move to the more radical EfS, in which curricula are transformed to “build-in” sustainability. Although any change can be perceived as a threat to some, these “rebuild, or redesign” and integrative (interdisciplinary) expectations would be a serious challenge to those academics who perceive the

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

Figure 2. Stages for the development of sustainable education in universities (Sterling & Thomas, 2006).

strengths of universities to be related to their undisciplinary structures for research and teaching. This challenge is increased substantially by the contested nature of sustainability, and sustainable development, and because we do not have a clear understanding of exactly what we should be aiming to achieve, that is, exactly what is that elusive goal called “sustainability.”

As steps toward SE, ESD, and EfS are basically about trying to bring together largely different value sets—economics and environment—with society somewhere in the middle. A clash of values will not deliver consensus but it can open up discussion—a process for problem solving and clarifying individuals’ values. For SE, we are looking at a transformation across the whole university (curriculum, operations, administration, research, and vision), requiring a corresponding transformation in the role of values; EfS, with its focus on curriculum change, may be a testing point for how much change is possible.

The context for such discussions is that we do not know what a sustainable city or sustainable society looks like. We have had just 20 years talking about sustainability in international and other forums. Even if we did have an idea of what a sustainable city looked like, how could we be sure it is the correct city form? This vision would be contested by others in the global, or even local, community who will have their own ideas of a sustainable city. Consequently, we need a process to help us on the journey to sustainability—whatever that is. We need questions, analysis, reflection, investigation, and more, to help students, academics, and the community engage in discussion to help guide the process.

One process has been to think about the future based on an extrapolation from the past. However, because of the complexity of the biophysical environment, and of societies, education that prepares young people for the future needs to be more appropriate and sophisticated than a simple “more of the same” approach. Yet, authors such as Marginson and Considine (2000) have written about the extent to which universities have become more like corporations with their focus on money and the direct application of their products (i.e., graduates) to the current market and

industry needs. As noted by Scott and Gough (2006) “too close a focus on society’s *present* expectations for the future—based on presently available knowledge—may have the effect of limiting that future, through a failure to encourage students to test or challenge those expectations” (p. 93). They argue that an instrumentalist view of higher education, which is promoted through the “managerial approach,” attempts to identify the skills-needs of the future economy. However, these skills are not only largely unknown to us but to a significant degree are unknowable.

A different process is needed if we are to engage with the many issues associated with sustainability. The shape of a process has been sketched by Butcher (2007), who sees that sustainability literacy³ is a “moral and behavioral agenda rather than an educational one” (p. 13). He is concerned that “sustainability literacy involves universities acting as social engineers to promote green thinking: pro-localism, anti-consumerism, anti-genetically modified food and critical of globalisation.” Although these concerns appear to be new, universities have been examining aspects of sustainability and environmental management through their disciplines for years, as evidenced by the adoption of triple bottom line concepts. Sustainability literacy takes this further, as Butcher suggests:

Advocates argue that all subjects, from economics to classics, should embed sustainability literacy in their curricula. But why not simply educate rather than advocate? The promotion of sustainability as the holy-grail is likely to lead to differences of opinion ... (p. 13).

He also emphasizes that “universities should teach. They will reflect the prevailing body of knowledge, and they should aim to encourage students to question orthodoxies” (p. 13). Clearly he sees the need for a pedagogy that engages learners in discovery and thinking, an approach supported by AtKisson (1999), who sees that sustainability will not come from “ready-made solutions.” The only option will be for professionals to have the capabilities to improvise, adapt, innovate, and be creative.

Similarly, Dawe, Jucker, and Martin (2005) have suggested that students should undertake a broad inquiry into issues that would be relevant to many areas of learning and life. They propose that “sustainability literacy is about learning how human actions affect the immediate and long-term future of the economy and ecology of our communities. It is concerned with how we can learn to live and work on a planet whose resources are finite” (p. 2). Within this view, individuals could take an advocacy stance, about which Butcher is concerned, but it leaves open many additional options. Dawe et al. have identified examples of approaches for teaching sustainability literacy that support the development of such skills as interdisciplinary thinking, problem solving, and team working. Associated with the teaching that facilitates these skills are three broad principles: educators as role models and learners; experiential learning by reconnecting to real-life situations; and holistic thinking. The relevance of these to curricula is considered below.

Recent development of the concepts associated with sustainability and the range of terms used has led to differences in understanding in educational circles. In universities, there is said to be confusion about the terms sustainable development and sustainability (Filho, 2000; Reid & Petocz, 2006), and research into these subjects (titles and content) indicates a lack of consistency in the use of the terms (Sherren, 2006). Furthermore, Lang (2004) notes that ESD focuses on the learning process required to support sustainable development, while EfS emphasizes building our capacity to live more sustainably. In addition, ESD has been closely associated with economic development, too instrumentally oriented, and missing cultural, personal, and valuative dimensions (Sterling & Thomas, 2006), so that EfS is preferred by some (e.g., Lang, 2004).

It is clear from reports such as the Millennium Ecosystem Assessment (2005), indicating the serious threats to the global environment, that we cannot afford time to resolve fine distinctions but need to act. Hence, although recognizing the debate regarding the use of the terms ESD and EfS, I will not labor the distinctions between them here. Of more concern is to engage curriculum developers to embrace the broad concepts. Sustainability implies “not just another issue to be added to an overcrowded curriculum, but a gateway to a different view of curriculum, of pedagogy, of organizational change, of policy and particularly of ethos” (Sterling 2004, p. 50). As a consequence, full achievement of ESD/EfS would require a significant change in the concept of university education, a point to which I will return.

If we are to educate students to achieve sustainability in the absence of a clear understanding of the physical and social representations of sustainability, we need to be facilitating a process that explores the relevant territories to assist us all on our “journey” to sustainability. Hence, our option is to base learning approaches on developing understanding and competence in the processes that have the potential to lead to sustainability.

Role of Student-Centered Pedagogy

The terminology associated with sustainability may be important but of greater consequence to students are the educational experiences provided for them. Hence, we need to consider what constitutes an appropriate curriculum and pedagogy. A critical issue is whether ESD merely supports approaches that have led to calls for actions such as Agenda 21 or ESD can assist change. In the words of Huckle (2006):

ESD focussed on environmental science and management and ESD focussed on values and behavior change both regard ESD as an aspect of policy: a way of closing the ‘value-action’ gap. . . . It is clearly important that pupils have an understanding of environmental science and management and develop social and environmental responsibility, but without ESD as a form of socially critical education, there is a danger that ESD remains merely an aspect of policy flawed by instrumental rationality and modernist assumptions (p. 32).

The critical nature of ESD is expanded by Sterling (1996) who has suggested an overall view of the characteristics of ESD/EfS as representing not simply a list of sustainability concepts that might be added on to an existing curriculum but a significant reconfiguration of educational purpose and approach. The focus is on ethical engagement, the processes of critical analysis, and the use of holistic approaches. These qualities are also emphasized by Tilbury (2004):

The terms “critical reflection,” “values clarification,” and “participative action” have become core components for Environmental Education for Sustainability. . . . These approaches provide opportunities for students: to engage in critically reflecting upon the basis of their socio-cultural values and assumptions; to identify how they are conditioned and confined by the socio-cultural structures they are operating in and, more significantly, to build their capacity as agents of change (p. 101).

She sees that these generic skills are critical for students who will need to contribute to sustainability while they are at university and later in their professional and personal lives. The Organisation for Economic Co-operation and Development (OECD) Education Ministers have also taken a long-term view of education and see that that “Sustainable development and social cohesion depend critically on the competencies of all of our population—with competencies understood to cover knowledge, skills, attitudes and values” (OECD, 2001, p. 4).

The emphasis on the broad and student-focused nature of ESD is noted in UNESCO documents that propose that:

[ESD] is characterised by six features. It is interdisciplinary and holistic; values-driven; encourages critical thinking and problem solving; uses a wide range of methods, media and activities; fosters participatory decision-making; and addresses local as well as global issues using the language(s) which learners most commonly use” (Huckle, 2006, n.p.).

Similar characteristics are noted by Lang (2004) who also considers mechanisms for implementing ESD, where the different learning approaches, and training of the teachers, are also discussed (see Figure 3). Such perspectives emphasize that EfS/ESD is not a collection of “facts and figures” achieved by memorizing information or set responses; similar positions are presented by Simon (2002) and Baud (2003). The life and the future issues we are dealing with are complex and dynamic and do not have easy solutions. Hence, Sterling and Thomas (2006) argue for the development of “sustainability literate” students, able to contribute to a society that is low in the use of energy and raw materials and high in terms of intellectual capital, with all the inherent values that these positions assume. This requires “both academics and their students to question, to analyse, to re-think, and as necessary, reorient their teaching and learning practices toward open-ended, real life and purposive enquiry” (p. 354). Similarly Scott and Gough propose that learning associated with sustainable

Principles of Education for Sustainability ^a	Five-point plan for Education for Sustainable Development (ESD) ^b	UN-based perspective of priorities for ESD ^c
<p>Strong values base to allow for connectivity of self with community; sustainability values include: compassion, equity, justice, peace, cultural sensitivity, respect for the environment, and recognition of the rights of future generations</p>	<p>1. Recognize and encourage the innumerable grass-roots movements working towards sustainable development; be sensitive to the enthusiasm, sensitivity and creativity that these grass roots movements can bring to bear on the issues.</p>	<p>1. Improving basic education for an educated citizenry to carry out informed and sustainable development.</p>
<p>Critical thinking and reflective learning to allow for transformational change in thinking to inform practice</p>	<p>2. Bring pressure on governments to support educational programs to ensure that populations are adequately informed across sectors; lifelong learning</p>	<p>2. Reorienting existing education towards sustainable development</p>
<p>Future-focused to consider long term consequences into planning and creating a sustainable future</p>	<p>3. Assist teachers to find new ways to incorporate the issues of sustainable development into the standard subjects.</p>	<p>3. Public awareness & understanding of sustainability to build capacity for environmentally literate citizens, across sectors of society; media has a significant role to play</p>
<p>Participation is fundamental to active citizenship and democracy as embodied in political sustainability</p>	<p>4. Learn to apply new technologies to get enough information to people to enable them to make informed judgements & to take informed political action; mechanism for increasing communication & civility</p>	<p>4. Training for environmental literacy across sectors; particularly in the workplace through a transdisciplinary approach</p>
<p>Learning for life recognizes that sustainability is linked to lifelong learning and not confined to formal schooling.</p>	<p>5. Find ways to educate teachers and professors to accept their responsibility to develop the whole person.</p>	

Learning across

boundaries is imperative if sustainability issues are to be understood holistically.

Transformative to ensure that individuals, communities, systems move away from unsustainable to sustainable practices.

^a Summary of key themes as depicted in the New Zealand policy document, *See Change: Learning and education for sustainability* (Parliamentary Commissioner for the Environment, 2004)

^b A five-point plan proposed for education for sustainable development by Carlos Hernandez and John Nevin (Hernandez & Mayur, 2000, pp. 17–18)

^c As discussed by Charles Hopkins and Rosalyn McKeown (2002) and the priorities defined in the draft of the *UN DESD Framework for a Draft International Implementation Scheme* (UNESCO 2003).

Figure 3. Models for ESD implementation, defining its key components (from Lang, 2004).

development needs to challenge “individuals’ views of the world as a means of influencing their characteristics and hence ways of thinking and living” (in Huckle, 2006, n.p.).

Parallel Directions: Transformative Learning and SE

The underlying themes of this discussion about SE show strong connections to the elements of transformative learning: “Broadly, transformative learning occurs when people critically examine their habitual expectations, revise them, and act on the revised point of view” (Cranton, 2006, p. 19). More specifically, Mezirow (2000, p. 20) identifies transformative learning as problem solving by “defining a problem or by redefining or reframing the problem.” This type of learning has direct relevance to the attributes of the “transferable skills” that are increasingly being sought in graduates. Referring to Bridges, Assiter (1995) describes these skills as “the metaskills, the second-order skills which enable one to select, adapt, adjust and apply one’s other skills to different situations, across different social contexts and ... across different cognitive domains” (p. 164). The emphasis on “transferable” capabilities is also reinforced in the criteria for “sustainability literacy skills and knowledge” identified by the Higher Education Academy (2006, p. 6):

- an appreciation of the importance of environmental, social, political, and economic contexts for each discipline

- a broad and balanced foundation knowledge of sustainable development, its key principles, and the main debate within them, including its contested and expanding boundaries
- problem-solving skills in a nonreductionist manner for highly complex real-life problems
- ability to think creatively and holistically and to make critical judgments
- ability to develop a high level of self-reflection (both personal and professional)
- ability to identify, understand, evaluate, and adopt values conducive to sustainability
- ability to bridge the gap between theory and practice; in sustainable development, only transformational action counts
- ability to participate creatively in interdisciplinary teams
- ability to initiate and manage change.

An important caution is noted by Gibbs, Rust, Jenkins, and Jaques (1994), however. They point out that these skills do not transfer easily between different contexts. Rather, similar contexts are needed, so it is insufficient to try to “tack” transferable skills onto university curricula, since the skills do not transfer effectively to nonacademic contexts. Instead, they suggest:

It is necessary to bring elements of the world of work into the classroom, to confront students with situations and problems which resemble those they will eventually have to tackle, and to allow them to learn the necessary skills in work-like contexts, tackling the problems in the way that they will eventually have to tackle them outside academia (p. 4).

There is a clear move away from the traditional knowledge-focused and lectureship-style teaching to a more process-based and student-focused approach to learning. In this instance, ESD/EfS personalizes the learning experience in the context of a developing interest and a sense of responsibility toward the environment and society, producing a capacity for enacting change. Such practices were found in a survey reported by Holdsworth (2006), where respondents described challenging students’ preconceptions, challenging their way of thinking, showing students that they can make a positive difference to the state of the world, and discussing hope for a sustainable future.

Some see the role of ESD/EfS, and how it can be provided, as problematic. For example, Jickling and Wals (2008) contend that as international agencies and global forces have been major influences, the ESD “agenda has instrumental and deterministic tendencies that favor transmissive arrangements for teaching and learning over more transformative ones” (p. 18). Their cautionary note highlights the challenge for educators to implement ESD in ways that support the transformative learning that they (Jickling & Wals, 2008) advocate. Others also see the need for transformative learning. Without using the term, Huckle (2006) argues for a move away from prescriptive content:

Sustainability as a frame of mind, involves respect for human and nonhuman nature seeking their own fulfillment through a process of co-evolution that people can encourage with appropriate technology (tools, institutions, and ideas). As an educational process, ESD should primarily seek to develop such a frame of mind rather than develop “positive” attitudes and behaviour, realise sustainability indicators, and deliver “relevant” knowledge as set down in policy documents (p. 18).

Similarly, Fien (2001) proposes that EfS should “encourage teachers and students to engage in a ‘shared speculation’ about possible and alternative futures and ‘reflectively construct and reconstruct’ their visions of the future” (p. 17).

That sustainable development is not a goal in itself, but one of several inputs or drivers for transformative learning, is the issue for Wals and Corcoran (2006). They argue that “forcing consensus about the perspective of an ill-defined issue such as sustainable development is undesirable from a deep democracy perspective and is essentially ‘mis-educative’” (p. 103). The argument is that universities have a particular responsibility to facilitate alternative thinking. Specifically, universities “have a profound role to play in developing students’ dynamic qualities or so-called competencies. They will need these qualities to cope with uncertainty, poorly defined situations, and conflicting or at least diverging norms, values, interests and reality constructions” (p. 103). Yet, this does not mean small incremental change in curricula. Rather, for Wals and Corcoran (2006), EfS “means the creation of space for transformative social learning. Such space includes space for alternative paths of development; space for new ways of thinking, valuing and doing; ... space for deep consensus, but also for respectful disagreement” (p. 107).

Problem-Based Learning and Sustainability Education

A pedagogy often associated with the sorts of experiences and outcomes identified for EfS is problem-based learning (PBL). At the basis of PBL is transformative learning—a strength of this pedagogy. In discussing the role of PBL to facilitate sustainable development, Steinemann (2003) comments on the context for PBL:

Problem-based learning emphasizes learning by doing. It also provides a motivating context for learning. Students are given a real-world problem similar to those they would face as professionals. They take ownership of the problem, and the problem-solving process (p. 218).

PBL has five features that relate to the development of broad ability in students (Steinemann, 2003) and which are particularly relevant to EfS:

- making knowledge more accessible and applicable because it is used to solve real problems.

- developing skills for solving real-world problems, that is, ill-structured, open-ended problems of the type often faced in practice: “this is especially true with sustainability problems, which require flexible, integrative, multidisciplinary problem-solving approaches, rather than singular solutions” (p. 218). Importantly, the process of problem solving identifies the need for students to grapple with the difficulties of implementation and that the implementation of good solutions (assessed on narrow criteria) may nonetheless face barriers. As a consequence, students will develop an understanding of the role of social and political factors.
- facilitating active learning to find and evaluate information from various sources (ranging from documents to community members), thereby helping students to learn how to learn.
- facilitating motivation by focusing on real-world and current problems: abstract concepts are made more meaningful through their use in solving or improving a current problem relevant to the student and/or society.
- developing professional skills, especially cooperative and interdisciplinary problem solving, together with learning to work both independently and collaboratively. Students also “deal with multiple and often conflicting goals and values, work with constraints, and determine the most appropriate action to take, often in the absence of complete information or certainty” (p. 218). All these skills are critical components of EfS.

Ozturk, Muslu, and Dicle (2008) found that, in general, compared with teacher-centered approaches, there are strong indications to show that PBL assists nursing students to think critically. Critical thinking is one of the important aspects of EfS, as it encompasses the ability “to recognize an existing problem as well as an inquisitive attitude that seeks proof of the evidential. It involves gathering knowledge about the accuracy of this proof and the ability to make use of this knowledge and attitude” (Ozturk, Muslu, & Dicle, 2008, n.p.). In addition, experiences with PBL and engineering students have shown that it can provide an effective way to learn about sustainability, and to inspire broad thinking about sustainability, as well as demonstrate the motivation developed when students work on real-world projects and “make a difference” (Steinemann, 2003). Others, such as Meehan and Thomas (2006), working with students from three environment disciplines, report similar experiences.

The Centrality of Thinking

Associated with student-focused pedagogical approaches, such as PBL, which focus on the process of learning, is the need for thinking. Because the end point of sustainability is unknown, and the exact processes of reaching decision-points about sustainability are also unknown, we will need people (academics, graduates, and students) who are able to think—in such a way that they can assess the usefulness of the processes and assess the options that may appear to offer a sustainable future.

The role of thinking, to be reflective, and take an analytical approach was a major theme in Donald's (2002) study of eight disciplines, covering the physical sciences and humanities. Within her conclusions, she notes that students "rapidly become aware of the challenges they face: in their words, they need to develop their approach to learning, to think longer and deeper, to bring their knowledge together" (p. 298). She proposes that learning approaches should be "predicated on the principle of supporting students' higher-order learning and progress in thinking. Individualized, problem-based, inquiry-based, experiential, and cooperative or collaborative learning methods all contribute to higher-order learning" (p. 286). These points have direct relevance to sustainability education. Here, critical thinking has a central role and, as identified by the President of UNESCO, relates to the "very purposes of education" (Matsuura, 2007, p. 5). He continues:

The question of sustainability presents a challenge of learning how to live differently. . . . It certainly involves asking how we are to raise the next generations with values, attitudes and understandings different from our own. . . .

Education is key to this. But the issue is not just one of putting education for sustainable development into the curriculum and teaching materials, important though this is. It is also about cultivating capacities of critical understanding, careful analysis, respect for others and forward-thinking capacities, which enable people to reflect upon and change their behaviour, values and life-styles (p. 5).

Critical thinking is at the base of SE as presented by Sterling and Thomas (2006) above. It requires a different approach to learning compared with traditional approaches. In this respect, Brookfield (2005) sees that thinking critically is a process whereby individuals identify and investigate the assumptions they operate under, then adopt perspectives that are different from their "taken-for-granted" beliefs and behaviors. Specifically, the characteristics of critical thinking are that it:

1. is a productive and positive activity
2. is a process, not an outcome
3. shows manifestations that vary according to the contexts in which it occurs
4. is triggered by positive as well as negative events
5. is emotive as well as rational (Brookfield, 1987, pp. 5–7).

He suggests that with these attributes critical thinking is akin to "emancipatory learning" and "involves our recognizing the assumptions underlying our beliefs and behaviors" (pp. 12–13). As a consequence, critical thinking embodies the concept of "reflective learning," leading to three components: identifying and challenging assumptions; being aware of how context influences thoughts and actions; and developing and exploring alternatives to existing ways of thinking and living (Brookfield, 1987). Developing critical thinking in learners requires learning by the teachers, not only to support the learners, but to become "critical teachers." According to Brookfield:

1. Critical thinkers reject standardized formats for problem solving.
2. They have interests in a wide range of related and divergent fields.
3. They can take multiple perspectives on a problem.
4. They view the world as relative and contextual rather than universal and absolute.
5. They often use trial-and-error methods in their experimentation with alternative approaches.
6. They have a future orientation; change is embraced optimistically as a valuable developmental possibility.
7. They have self-confidence and trust in their own judgment (pp. 115–116).

Directions for EfS and SE

I have argued that the development of critical thinking is central to SE. The challenge to develop thinking skills is not a recent occurrence. Rather, the relationship between thinking and sustainability has a history spanning more than three decades. ESD/EfS evolved from environmental education, specifically to recognize and include the social, cultural, political, and economic aspects that are associated with environmental changes. Day and Monroe (2000) point out that:

Environmental education is mission-oriented. A good environmental education program does not stop with the presentation of information, but helps learners wrestle with values and gain the skills to take relevant and responsible action. . . . It teaches students “how to think” not “what to think” (p. 5).

Given the close relationship between environmental education and ESD/EfS, we can expect a similar explorative and analytical approach in ESD/EfS.

From the foregoing, we can conclude that EfS (through its “built-in” approach) and transformative learning have much in common regarding the development of students’ thinking. This thinking is also directly associated with the transferable skills that overlap with the attributes of EfS and which have been seen to be important for reflective and deep learning. Similarly linked is the role of PBL in developing reflective and analytical capabilities, where students experience situations and think through a route to a relevant outcome.

For Peck (1997), the importance of thinking cannot be underrated, as he says:

One of the major dilemmas we face as individuals and as a society is simplistic thinking—or the failure to think at all. It isn’t just *a* problem, it is *the* problem. . . . Thinking is difficult. Thinking is complex. . . . Given all this, if we are to think well, we must be on guard against simplistic thinking in our approach to analyzing crucial issues and solving the problems of life (pp. 25–26).

With the recognition that much has to be done to work toward sustainability, ensuring that our students and graduates are capable and critical thinkers will be a clear step to supporting the discussions and processes that can assist this process.

Academic discussion about differences in terminology (e.g., EfS and ESD) is important, but this should not delay us in moving toward the principles of sustainable development. Then, when we say students, and academics, need to think critically we also need to understand the focus of this thinking. Critical thinking implies thinking about the issues and level of details that are critical to any given problem. As the problem we are considering is the future of the earth, ecosystems, and human civilization, the key issues relate to the fundamentals of sustainable development, which are interpreted by Fien (2001), for example, as four interdependent systems:

- biophysical systems—provide the life support systems for all life, human and nonhuman
- economic systems—provide a continuing means of livelihood (jobs and money) for people
- social and cultural systems—provide ways for people to live together peacefully, equitably, and with respect for human rights and dignity
- political systems—through which power is exercised fairly and democratically to make decisions about the way social and economic systems use the biophysical environment.

Frameworks for thinking and learning about sustainable development are available. For example, Fien (2001) describes how the four systems are supported by three interrelated principles for sustainable living and the elements that would form a framework for critical thinking in the context of EfS:

- a systemic approach—showing a holistic perspective and accessing inter- and transdisciplinary understanding
- exploration of the effects of decisions and taking action—what change pressures will be placed on the biophysical environment and on society, who (human and other species) will be directly affected, and what will be the positive and negative effects
- decision making based on ethics—values-based exploration of the issues and options, with decisions being guided by a set of ethics derived from human rights and ecological rights.

In essence, these translate into supporting students to develop a very broad understanding of the world, their critical analysis of what effects (especially negative effects) will be caused, and making decisions informed by community-based ethics.

The last paragraphs propose one focus for critical thinking, and there should be debate about the applicability of this focus. This debate is in itself a mechanism to engage students and their academics in critical thinking, and could include discussion about the applicability of the focus of this thinking (as outlined above).

Debate is important but so too is action. Curriculum change is a social and political process, to which there are many barriers (de la Harpe & Thomas, 2009). Change directed “from above” (by administrators) is a problematic process in universities, but it can provide a context and facilitate change instigated by academics themselves. In parallel networks of academics that have a focus on change for EfS, such as “communities of practice” (Wenger, 1998) and “distributed leadership” (Spillane, 2005), groups establish communication between individuals seeking support for change. To guide the change, action-learning approaches enable the individuals to develop the rationale for change and the actions needed in the context of their institutions, disciplines, and professions (Holdsworth, Bekessy, Mnguni, Hayles, Thomas, 2006). At the basis of these approaches is the need for academics to think—a skill they will need if they are to assist their students to do likewise.

Several threads run in parallel to show that we need to develop critical thinking in students but to do this we also need academics to be thinking critically about their curricula. If we can achieve the latter, then the universities will be capable of developing strategies to elaborate on the content of SE (the topics that need to be covered) and the process for teaching (the details of the pedagogy). However, it is most important to help them develop as critical thinkers. I believe we should make this our priority.

Notes

1. It was noted that the aim of environmental education is to succeed in making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic, and cultural aspects and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and the management of the quality of the environment (UNESCO-UNEP, 1978).
2. ESD built on environmental education and 1990s concerns with population and development to focus on the following three perspectives: environment (e.g., natural resources); socioculture (e.g., human rights and security); and economy (e.g., poverty reduction and market economy; Sato, 2006).
3. Where a sustainability-literate person “understands the need for sustainable development, has the abilities to act in favor of it and can recognize others’ decisions and actions that favor it” (Forum for the Future, in Butcher, 2007).

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