

Achieving transformative sustainability learning: engaging head, hands and heart

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Abstract

Purpose – The current UN Decade of Education for Sustainable Development echoes many scholars' calls to re-envision education for sustainability. Short of a complete overhaul of education, the paper seeks to propose learning objectives that can be integrated across existing curricula. These learning objectives are organized by head, hands and heart – balancing cognitive, psychomotor and affective domains. University programs and courses meeting these learning objectives exhibit an emergent property here termed transformative sustainability learning (TSL).

Design/methodology/approach – Theoretically, TSL grew from traditions of sustainability education and transformative education. Practically, TSL emerged from experimental learning collaborations sponsored by the University of British Columbia in 2003 and 2004 in an effort to enable explicit transitions to sustainability-oriented higher education. Primarily through action research, these community-based, applied learning experiences constituted cyclical processes of innovation, implementation and reflection.

Findings – The paper finds: advancement of head, hands and heart as an organizing principle by which to integrate transdisciplinary study (head); practical skill sharing and development (hands); and translation of passion and values into behaviour (heart); development of a cognitive landscape for understanding TSL as a unifying framework amongst related sustainability and transformative pedagogies that are inter/transdisciplinary, practical and/or place-based; creation of learning objectives, organized to evaluate a course or program's embodiment of TSL.

Originality/value – By enabling change within existing structures of higher education, the paper complements and contributes to more radical departures from the institution. The work to date demonstrates potential in applying this learning framework to courses and programs in higher education.

Keywords Action research, Experiential learning, Education, Learning, Canada

Paper type Conceptual paper



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Purpose

Introduction

Calls for profound changes in higher education are becoming commonplace as both critics and visionaries lay out a context for sustainability education (Bowers, 2001; Bogotch, 2002; Furman and Gruenewald, 2004; Reid and Petocz, 2006; UNESCO, 2006). Against this backdrop, we offer universities and colleges the framework of transformative sustainability learning (TSL) and the organizing principle of head, hands and heart. TSL is a series of learning objectives corresponding to cognitive (head), psychomotor (hands) and affective (heart) domains of learning that facilitate personal experience for participants resulting in profound changes in knowledge, skills and attitudes related to enhancing ecological, social and economic justice. TSL contributes to the broad fields of sustainability education and transformative learning by articulating the relationship of these pedagogies to each other and to the organizing principle of head, hands and heart. In uniting the pedagogies that inform both sustainability and transformative education, we describe how learning in tertiary institutions can enact personal and societal transformations to sustainability. The explicit linking of sustainability and transformation enables TSL to emerge as a distinct and useful pedagogy, a cultural politic of schooling, learning and teaching (McLaren, 2003) that includes “what is taught, how teaching occurs, and how what is taught is learned” (Diekelmann, 2004).

Organization of paper

The first section of this paper outlines our approach in developing TSL. First we present the context for TSL, namely, the theoretical basis of sustainability education and transformative learning. Next, we introduce the case studies in sustainability education that we investigated. These UBC learning programs primarily informed our pedagogical inquiry into sustainability and transformative education; they constitute learning experiments and case studies, and laid the foundation for the development of TSL learning objectives. In the second section, we present our findings, which consist of:

- advancement of head, hands and heart as an organizing principle for cognitive, psychomotor and affective learning;
- development of a pedagogical landscape for understanding TSL as a unifying framework amongst related sustainability and transformative pedagogies pertaining to the agenda outlined by the UN Decade of EfSD; and
- creation of a program assessment matrix, organized by TSL learning objectives, to assess a program’s embodiment of TSL.

The latter finding, in particular, enables unification of sustainability programs, as the learning objectives of TSL have been gleaned from the sustainability pedagogies and case studies that we discuss. Through the program assessment matrix, we offer a working model for incorporating TSL into planning, implementing and evaluating sustainability programs. The third section concludes the paper, wherein we share some implications and recommendations of how the TSL framework can be used for program evaluation.

Approach

Context

Education is at odds with sustainability when modern economies function to damage and destroy the ecological systems that support human and non-human communities.

The explicit mission of contemporary school reform is to prepare students to perpetuate these problematic economies (Gruenewald, 2003). Many of today's social and ecological crises, such as climate change, a growing gap between the rich and poor, and two-thirds of the world population experiencing malnourishment, are perpetrated and perpetuated by people with post-secondary education (Orr, 1991; UNESCO, 2006). Mainstream higher education is implicated in the crises we are experiencing through training world leaders. If current education leads to unsustainability, then education can – and should – contribute to sustainability (Rees, 2003; Siebenhüner, 2000).

This research is based on two premises. The first premise is that students' localized places of study, work and recreation are the centers of their experiences that help teach them how the world works and how they fit into that world (Gruenewald, 2003). If the context for sustainability education is both the students' local environment and the institution of higher education, conflicts of interest are bound to arise. For this reason, sustainability education must be situated in both the university and community environments. Further, university and community must find or create the necessary common ground to minimize conflicts of interests. This may require university – community collaborations to increase both in breadth and depth.

Hence, the second premise of this research is that colleges and universities can take an active role as centers for both inquiry and action in local, regional, and global space(s) (Gruenewald, 2003). The relationship between sustainability and education are well documented (see for example, Talloires Declaration of University Presidents for a Sustainable Future (Mayer *et al.*, 1990); The Halifax Declaration (International Association of Universities, 1992), and The Earth Charter Commission (2000)). To accommodate this second premise, the very structural foundations and goals of schooling must be examined, and for the most part, rebuilt. Sustainability education must therefore be prepared to deconstruct and reconstruct all aspects of teaching and learning.

Higher education in western societies overwhelmingly fragments knowledge into disciplines and often leads to conflict between individuals, ideologies and nations (Birch, 1998), thereby furthering “the conquest of nature and the industrialization of the planet” (Orr, 1992, p. x). The prevailing design of education finds its roots in rationalism, a doctrine that knowledge is derived from an “evidence-based,” “rigorous” and “scientific” understanding of the world (Lambkin, 1998), which ideally leads to objectivity, certainty, universality and predictability (Phelan, 2004). The dominance of rationalism over other humanist qualities, such as intuition, common sense, creativity, ethics, memory and spirituality, serves to divide knowledge into smaller and smaller elements, ultimately leading society from a focus on reason to the realm of unreason (Saul, 1996). This model of rationalism has led to the search for value-free knowledge, a goal of efficiency and a focus on technology; there exists therefore, weariness “of curricula immunized from the human condition and devoid of story, attachment and meaning” (Phelan, 2004).

Detachment, however, does not translate into an absence of values. All curricula are in fact value-laden (Posner, 2004; Schubert, 1986). As Orr (1991) has said, we must not assume that it is education that will save us, or advance us or progress us; rather it is education of a certain kind. If our collective goal is a more sustainable present and future, we must manifest, encourage and impart values that contribute towards that goal.

Indeed, the recognition of the limitations of relying solely on rationalism has resulted in a call for the reassertion of humanist values and an acknowledgment of human fallibility (Saul, 1997); as such we agree that “it is time to ask what we need to know to live humanely, peacefully, and responsibly on the earth, and to set research priorities accordingly” (Orr, 1992, p. xi). We have the choice to change our educational mandates to stop teaching for “unsustainability” (i.e. the perpetration and perpetuation of social and ecological crises) and transform our pedagogical perspective to teach for sustainability (i.e. social and ecological justice). In order to move beyond reproduction of our social ills, teaching for sustainability requires transformation to new ways of approaching education and life.

The years 2005-2014 constitute the UN Decade of Education for Sustainable Development (EfSD), to be led by UN Educational, Scientific and Cultural Organization (UNESCO). This decade speaks to the bridges that must be built between academia and community needs, as well as the need to enact sustainability in higher education in a manner that positively affects the larger society and biosphere (Cortese and McDonough, 2003). UNESCO, as the UN’s lead agency to promote EfSD, has identified four main goals pursuant to the EfSD. The second of these pertains directly to higher education:

Rethinking and revising education from nursery school through university to include a clear focus on the development of the knowledge, skills, perspectives and values related to sustainability is important to current and future societies. This implies a review of existing curricula in terms of their objectives and content to develop transdisciplinary understandings of social, economic and environmental sustainability. It also requires a review of recommended and mandated approaches to teaching, learning and assessment so that lifelong learning skills are fostered. These include skills for creative and critical thinking, oral and written communication, collaboration and cooperation, conflict management, decision-making, problem-solving and planning, and practical citizenship (UNESCO, 2006).

We couple EfSD, or sustainability education with transformative learning, which can be understood as a process of effecting change in a particular frame of reference (Mezirow, 1997), often with an underlying assumption that individual and social change may result through transformative group learning (Cranton, 1994). In particular, we are concerned with perspective transformation (Mezirow, 1985) where the ultimate goal of transformative learning is to empower individuals to change their frames of reference or worldviews (Moore, 2005a). Processes of critical reflection (Moore, 2005a; Cranton, 1994) of “both habits of mind and points of view” (Moore, 2005a) are fundamental to such learning, which invokes processes of re/constructing knowledge based on life experiences, and arriving at new ways of thinking and being (Cranton, 1994). Such education is founded on critical pedagogy, which critiques the idea that knowledge is value-free and works to transform society to be more democratic and less oppressive (Share, 2003). Transformative learning in the context of higher education requires major shifts in university structures to enable such critically reflective, inter/transdisciplinary, experiential and place-based learning to emerge; and also for university educators to better prepare for the disorientation and other unexpected potential outcomes that may arise through this type of learning (Moore, 2005a). In identifying all sustainability education to have a common vision of perspective transformation, we may better encourage and enable all participants of education to challenge and be open to change in their own minds, beliefs and behaviours.

Reflection on the content and relevance of education is necessary in reshaping teaching and learning for more productive means and outcomes. The sustainability education that emerged since the Earth Summit of 1992 has as of yet proven insufficient in combating global devastations (Raskin *et al.*, 2002, p. x). Particularly because sustainability is still often viewed as a messy and contested term, these changes can only occur as we stop seeking standards for sustainability and instead start setting them, particularly for the sustainability education movement (Arjen and Jickling, 2002). This paper is particularly focused on helping to set standards for sustainability education. It is hoped that integrating the TSL learning objectives across curricula will help inform the rethinking of higher education.

The UBC learning programs as TSL case studies

In undergoing this pedagogical inquiry, we engaged in case studies on sustainability education, focusing on process as opposed to product. Case study is useful in serving as an “intensive detailed description and analysis of a single project, program, or instructional material in the context of its environment” (Frechtling and Sharp, 1997, Ch. 9). Our case studies served as fruitful terrain to engage in action research around sustainability education, where we iteratively cycled through series of reflection, innovation and implementation (Stringer, 1999).

The concept and criteria of TSL and its learning objectives primarily evolved from a series of three initiatives undertaken at UBC to explore and expand sustainability education; we used these learning experiences to investigate, develop, apply and evaluate the TSL learning objectives. These case studies all focused on participants’ interactions with materials and opportunities presented to enhance understanding and connection with the concepts of sustainability and global citizenship. All three cases were primarily conducted at the UBC Centre for Sustainable Food Systems at UBC Farm, and all involved explicit attention to the learning domains of head, hands and heart. In order to do so, each of these integrated case studies drew on related pedagogical models, and utilized place-based, integrated teaching, learning and fieldwork. Two of the authors were involved as instructors and leaders in these courses.

The three case studies were:

- (1) The first offering of The Science and Practice of Sustainability (TSAPOS) (2003).
- (2) The second offering of TSAPOS (2004).
- (3) Edibility and Awareness: Sustainable Food Systems (2004).

What follows is a short description of each course:

- *The Science and Practice of Sustainability 2003 (TSAPOS I); Northern Inner Coast Pod, August 6-30, 2003.* TSAPOS I was a six-credit UBC Department of Earth and Ocean Sciences course (EOSC 448; GEOG 447). This course was co-developed with faculty, staff, student and community participants, and funded by the UBC Teaching and Learning Enhancement Fund. TSAPOS 2003 was home to 45 students from nine UBC Departments, and involved a collaborative effort of six co-instructors from different academic backgrounds. The nature and curriculum of the course was transdisciplinary, including collaborative group work, community service, experiential education,

ecological-footprinting, reflective practice and participatory decision-making. Of the month-long course, all participants were at UBC for the first and last week, with approximately half of the students and instructors living at UBC Farm in the first season of an on-site pilot ecovillage. This case study focused on one of the three interconnected, yet autonomous learning “pods” of TSAPOS, facilitated by two instructors and 12 students who traveled to the Northern Inner Coast of Vancouver Island for the middle two weeks of the four week course. This group used the community service-learning model to explore the interfaces of biophysical, personal and social sustainability, alongside members of First Nations, governments, NGOs and industry, and numerous community educators and organizations.

- *The Science and Practice of Sustainability 2004 (TSAPOS II); August 13-28, 2004.* In the second year of TSAPOS, the course was held entirely at UBC Farm and efforts were focused on the further development of the pilot ecovillage, initiated the previous year. The course was shortened to two weeks and three credits (EOSC 448); there were two instructors, two camp kitchen coordinators and 20 students in total. The course curriculum of TSAPOS II included: non-formal education, participatory decision-making and collaborative group work. TSAPOS II focused on personal sustainability and practical skill building.
- *Edibility and awareness: sustainable food systems; February 16-19, 2004.* The UBC Learning Exchange sponsored a community service-learning project at UBC Farm for four days over reading week of 2004. This program was open to UBC students and UBC Learning Exchange patrons from the Downtown Eastside. Local educators and activists were invited to share presentations and participate in some of the activities. There were four leaders and 18 participants. Some of the participants were involved as part of a course project, through enrollment in two UBC Human Ecology courses (BIOL 345; HECO 200). The curriculum focused on global citizenship, agroecology, food systems and local economic systems. Reflective practice was utilized as the bridge between the theory and practice of the curriculum.

These case studies all shared a focus on sustainability and global citizenship, as well as a goal of participant perspective transformation through group experiential education. Beginning with those common goals, the instructors used a shorthand of “heads-on” and “hands-on” to denote the cognitive and applied activities of each day. Certain aspects of course, involvement, such as group reflection or individual journaling about the various activities, learning events and internal experiences of the day, led the instructors (whom comprise two of the authors) to realize that the courses actually had three distinct areas of engagement: heads-on, hands-on and hearts-on. In naming this triad of engagement, the courses progressed through attention to and integration of all three of these learning domains. Through reflection on the courses, head, hands and heart emerged as an obvious planning principle for sustainability education. Further, we understood that through engagement in these three areas, we could help to enact a useful planning and evaluation tool for sustainability education.

Findings

This research resulted in three major findings.

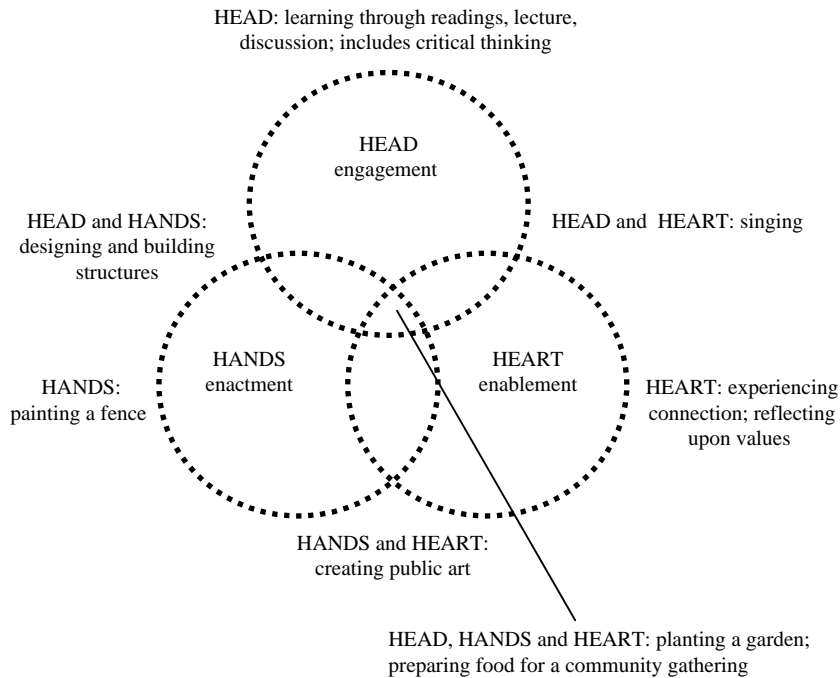
Head, hands and heart as an organizing principle

Head, hands and heart is essentially shorthand for engaging cognitive, psychomotor and affective learning domains (Bloom *et al.*, 1964). University programs and courses meeting these learning objectives exhibit the emergent property that we have termed TSL, learning that facilitates personal experience for participants resulting in profound changes in knowledge, skills and attitudes related to enhancing ecological, social and economic justice. TSL learning objectives emerged from study of other sustainability and transformative pedagogical models, methods and outcomes, and through participation in the aforementioned experimental learning collaborations that we considered as case studies.

Learning outcomes encompass both specific and general knowledge, skills and attitudes acquired through participation in an educational activity (British Columbia Standing Committee on Evaluation and Accountability, 2001), and generally refer to explicit expectations of what a student will be able to do as a result of a learning activity (Jenkins and Unwin, 1996). “Bloom’s Taxonomy” (Bloom *et al.*, 1964), offers an alternative to learning outcomes by way of learning domains (Clark, 2000); Bloom’s model proved helpful in laying foundation for developing the learning objectives of TSL. We compiled the TSL learning objectives as a means of mapping learning goals, strategies, and outcomes, drawing on the pedagogical models noted above for guidance.

Our strategy was quite simple: integrate learning processes rooted in participants’ heads (cognitive domain; engagement, e.g. through academic study and understanding of sustainability and global citizenship), hands (psychomotor domain; enactment of theoretical learning through practical skill development and physical labour (e.g. building, painting, planting)), and hearts (affective domain; enablement of values and attitudes to be translated into behaviour, e.g. developing a learning community with individual and group responsibilities) (Figure 1). The goal of this integration is to effect what Hauenstein (1998) refers to as the behavioural domain, the ultimate goal of transformative learning. We propose that the combination of Hauenstein’s educational taxonomy for describing student learning outcomes, with our TSL pedagogy for program evaluation, provides a useful conceptual framework to promote locally applicable sustainability attributes and content knowledge. This combination may also enable further insight into whether sustainability has “been learned,” is believed, and/or is practiced in participants’ lives, that is, whether and how transformation occurs. TSL learning objectives are meant to direct, encourage and reinforce learning, and are designed to assist participants’ learning through the development of well-integrated programs. Through integration and implementation of the TSL learning objectives, instructors can further develop their current practices by ensuring that there is a balanced approach to the three domains of potential transformation. Uniting the head, hands and heart of teaching and learning ideally enables targeting and transformation of the higher order “behavioural domain” (Hauenstein, 1998).

Related pedagogies: what they are and what they share. TSL further emerged from study and implementation of pedagogical models that pertain to the agenda outlined by the UN Decade of EfsD. These pedagogies enable inter/transdisciplinary, experiential, and place-based sustainability learning. The pedagogies that we found to be most relevant are: action learning, community service-learning, critical emancipatory pedagogy, environmental education, participatory action research, pedagogy for eco-justice and community, problem-based learning, and traditional ecological knowledge.



Note: There are seven combinations that can emerge; an example of how each may be actualized is provided

Figure 1. A Venn diagram depicting constituents (combinations of head, hands and heart) and synergies (in spheres) of the TSL pedagogy wherein the principle of head, hands and heart engages and enables participants to enact sustainability

See Table I for definitions and brief overviews of intended learning outcomes of these educational models. These learning models provided insight into the social and historical foundations for the importance of sustainability in higher education; further, these models affirmed the basis for the development of TSL.

Mapping the pedagogical landscape. The existing pedagogies we explored, though broad in their combined scope, are often viewed as distinct from one other, remaining more narrowly focused and not imparting truly transformative teaching and learning experiences (Lange, 2004). In developing TSL, we studied some established forms of sustainability and transformative education. In so doing, we began to develop a pedagogical landscape, a terrain with which to better understand their relationship to each other.

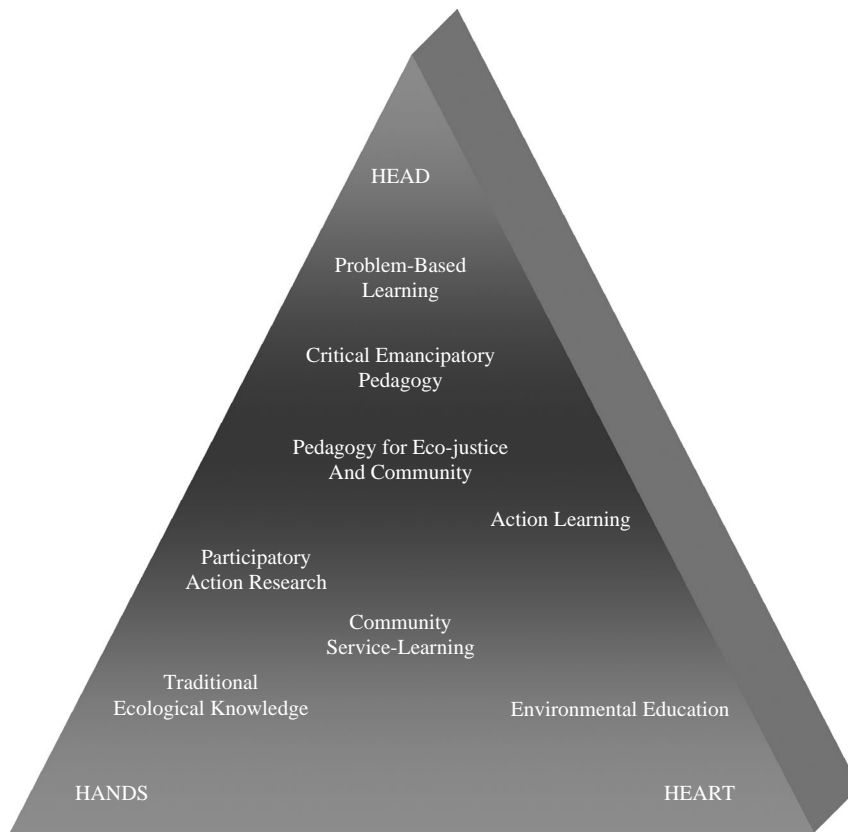
We grouped the pedagogies listed in Table I according to head, hands and heart, creating a three-sided “pedagogical landscape.” The pedagogies are not fixed in position; their relative positions will be influenced by their particular practice. This ternary diagram provides a simple way of mapping the pedagogies, through depiction of head, hands and heart as an organizing principle, as well as the relation amongst learning models, the organizing principle, each other and TSL (Figure 2). We propose TSL as a comprehensive framework for these seemingly discrete genres of education. In this case the TSL model organizes and encapsulates that which exists, thereby re-creating, rather than creating, the broad fields of sustainability and transformative education.

Pedagogical model	Overview of intended learning outcomes
Action learning	A form of experiential learning that enlists peers in helping learners question their assumptions and (optimally) experience a paradigm shift before applying their learning in new situations (McGill and Brockbank, 2004; Revans, 1998)
Community service-learning	An educational approach that integrates service in the community with intentional learning activities. Within effective CSL efforts, members of both educational institutions and community organizations work together toward outcomes that are mutually beneficial (Hayes, 2006, p. 2)
Critical emancipatory pedagogy	An ideology for learning facilitation that arises from an emancipatory tradition, focusing on equity amongst classes, races and genders (Mezirow, 1985; Freire, 1970)
Environmental education	An approach to teaching and learning that provides people with experience and knowledge to care for our environments (Gruenewald, 2004; Orr, 1994)
Participatory action research	A summary of terms in social science that refer to involvement of participants in the research process, commitment to social change, and that include aspects of social learning. There are many ways to define true participation, action and exactly what constitutes true research (Moore, 2005b; Coghlan and Brannick, 2001, Ch. 1; Stringer, 1999)
Pedagogy for eco-justice and community	An ideology for learning facilitation that acknowledges and finds tensions in "industrial mindset," works to replace attitudes with the metaphor of ecology (Bowers, 2001)
Problem-based learning	A framework for learning that is focused, experiential and organized around investigation of real-world problems. Authentic experiences foster active learning, support knowledge construction and integrate school learning and real life (Association for Supervision and Curriculum Development, 2005; Barrows, 1994)
Traditional ecological knowledge	Knowledge bases built by local or traditional resource users, as opposed to "experts"; argues for acknowledgement of more diverse forms of knowledge (as opposed to simply expert western science) (Berkes, 2004; Turner <i>et al.</i> , 2000)

Table I.
An overview of some established pedagogies that relate to sustainability and transformative education

Analyzing sustainability programs

Efforts to determine whether sustainability programs meet the learning objectives of TSL culminated in the creation of a simple program assessment matrix (Table II). The learning objectives that inform this matrix are a combination of guidelines, strategies, outcomes and assessment criteria, derived from study of existing pedagogical models. Decision matrices are design tools used in an array of fields to aid in decision-making (Anderson, 2000). The program assessment matrix we present is based on a decision matrix pattern, arranged in a grid with decision criteria (i.e. learning objectives) forming the rows, and decision options (i.e. learning programs) forming the columns. The learning programs, which are all valid or potentially successful options, are scored against the TSL criteria of learning objectives. The goal of "scoring" learning programs is to see where each is strong and where there is room for improvement. Learning programs may be compared against one another based on the objectives that may or may not also include different weighting factors to account for constraints or



Notes: This ternary diagram charts the relatedness amongst these pedagogies to each other and to the foci of Head, Hands and Heart. The pedagogies are not fixed in position; their relative positions will be influenced by their particular practice

Figure 2.
A “pedagogical landscape” of sustainability and transformative learning models based on the organizing principle of head, hands and heart

significance of the variables at hand (Anderson, 2000) (Table II). Various methods for assigning values can be utilized, but each is semi-qualitative and subjective to some degree. The objective in utilizing a modified decision matrix for the case studies was not to identify the “best” learning program; rather, the goal was to determine how different programs were meeting each objective. The decision matrix therefore enables comparison of each learning program against a common set of learning objectives and assignment to each program a score of 0-4 on each learning objective. A mark of 4 indicates that the program met a certain objective to the best of its ability while a mark of 0 indicates that the program has not addressed that area. More detail on the criteria of this rubric is provided in Table II.

Often, objectives are weighted in a manner that indicates their hierarchy within the decision-making process. Although we grouped the objectives, we did not assign weightings for them, as it was determined that each criterion was equally important within the TSL framework (i.e. “cognitive engagement” and “transdisciplinary curriculum” are equally important as “fun” as objectives). TSL is a new framework of

Table II.
A matrix of TSL learning objectives, with a possible ranking of 0-4, depending on how well each objective is met

Learning objective	Description	0 Not addressed ^a	1 Beginning ^b	2 Developing ^c	3 Accomplished ^d	4 Exemplary ^e
<i>Head</i>						
1. Cognitive engagement	Requires observable, sustained, engaged attention during a task requiring mental effort (Ramsden, 1992; Corno and Mandinach, 1983)					
2. Transdisciplinary curriculum	Uses a curriculum that integrates knowledge from numerous distinct disciplines, embedding streams of knowledge into one another, and integrating them in new ways (Moore, 2005a, b; Somerville, 2000)					
3. Critical thinking	Encourages participants to analyze ideas by reflecting on them, identifying categories or components that comprise them, considering what they are based on and whether or not they apply in a given situation (Paul and Elder, 2001; du Boulay, 1998; Ramsden, 1992)					
4. Systems thinking	Encourages use of complexity theories and an ecosystem approach to recognize that seemingly separate activities, from many interdependent social, ecological, and economic systems, form one complex global system (Holling, 2001; Kay and Schneider, 1994)					
5. Understanding of sustainability	Presents sustainability as a complex, interdisciplinary challenge that must integrate socioeconomics, socio-cultural, and biophysical and ecological concepts, strategies and goals (Moore, 2005a, b; Grimm, 2004)					
6. Understanding of global citizenship	Fosters an appreciation of issues surrounding the fulfillment of responsibilities as citizens of the world (Banks, 2003; Davies, 2001; Reardon, 1988)					
<i>Hands</i>						
<i>Personal</i>						
1. Experiential learning	Promotes learning through direct, self-initiated experience, reflection on experience, formation of ideas that are applied to new experiences (Roberts, 2006; Kraft and Sakofs, 1988; Kolb, 1984; Dewey, 1938)					
2. Applied learning	Contextualizes learning to empower and motivate students, while helping to develop skills and knowledge required for employment, further education and active participation in communities (Barrows, 1994)					

(continued)

Learning objective	Description	0 Not addressed ^a	1 Beginning ^b	2 Developing ^c	3 Accomplished ^d	4 Exemplary ^e
<i>Classroom</i>						
3. Democratic and participatory learning environment	Encourages course participants to share access to ideas and enactment of leadership and justice within the learning through participatory decision-making. Participants own processes and therefore solutions (Moreno-Lopez, 2005; Kaner <i>et al.</i> , 2001; Tayer-Bacon, 1996)					
4. Conflict resolution	Uses creative and effective ways to avoid, transform and resolve conflict (Kaner <i>et al.</i> , 2001; Jones and Kmitra, 2000; Palmer, 1998)					
<i>Community</i>						
5. Collaborative	Introduces new perspectives and new knowledge, leading the group to new discoveries. Encourages united action by course participants for common purpose or benefit, with a willingness to adjust to individual differences to reach agreement					
6. Service learning	Participants share in the construction of their knowledge (Cranton, 1996; Brufee, 1981) Helps foster civic responsibility by requiring participants to engage in service that meets a need in a local community, including structured time for participants to reflect on their service experience. Requires participants to form meaningful collaborations with members of the greater community (Hayes, 2006; Eyler and Giles, 1999; Jacoby, 1996)					
<i>Heart</i>						
1. Empowering	Seeks to impart participants with a greater sense of authority and enablement to participate as decision-makers in their socio-cultural realities (Freire, 1970; Moreno-Lopez, 2005)					
2. Creative	Includes processes that brings new things into being, and allows participants to do the same (Reid and Petocz, 2006; Jackson, 2006)					
3. Fun	Encourages participation in amusing, enjoyable and motivating ways (Rieber <i>et al.</i> , 1998; Malone and Lepper, 1987; Csikszentmihalyi, 1975)					

(continued)

Table II.

Learning objective	Description	0 Not addressed ^a	1 Beginning ^b	2 Developing ^c	3 Accomplished ^d	4 Exemplary ^e
4. Values-focused thinking	Encourages creating better alternatives for decision problems, identifying decision opportunities more appealing than the decision problems that confront you, and articulating and using fundamental values to guide and integrate decision-making activities. Includes reflection on experiences by thinking about, mulling over and evaluating them (Keeney, 1996, 1992)					
5. Inclusive	Works to promote equitable and just access to involvement in the educational, social and cultural activities of the course and beyond, dictated by reason, conscience, and a sense of what is fair to all (Macfarlane, 2004; Wane <i>et al.</i> , 2004)					
6. Place-based	Engages learners through the positioning of a curriculum within the context of participants own lives, communities, and regions, thereby taking advantage of students and communities natural interest in the local (Smith, 2002; Gruenewald, 2003)					

Notes: The learning objectives are organized by head, hands and heart, and can be integrated across post-secondary curricula to plan for and evaluate TSL. Head, hands and heart corresponds with cognitive, psychomotor and affective domains of learning; collectively, these domains can enable perspective and possibly behavioural transformation. ^aObjective is not addressed in the course/program; ^bObjective is beginning to be addressed in, but not exemplified by, the course/program; ^cObjective is developing into an important and well addressed aspect of the course/program; ^dObjective is well established and forms a fundamental aspect of the course/program; ^eObjective has been met and/or exemplified within the course/program at the highest known level

learning objectives that emerged from study and implementation of established pedagogies relating to sustainability and transformative education through integration of cognitive engagement, psychomotor involvement through manual or physical skills, and affective growth in feelings or emotional areas (Bloom *et al.*, 1964). By evaluating how programs score on this matrix (and potentially how programs score relative to each other), educators can modify their curricula and objectives, as they see fit. Specifically, the use of the matrix allows educators to highlight strengths and weaknesses in courses or programs. Monitoring the integration of cognitive, psychomotor and affective domains is useful in further iterations of the program.

Implications

This paper introduced the TSL model by positioning this framework as a means to engage and enable learners to enact principles, values and goals of sustainability for perspective transformation, and ideally, ultimately to societal transformation. The TSL model, and particularly the assessment matrix, may better enable transformations to sustainability through more effective planning, implementation and evaluation of collaborative sustainability pedagogies, particularly when paired with iterative processes of reflection, innovation and implementation. The current UN Decade of EfSD echoes many scholars' calls to re-envision education for sustainability. Short of a complete overhaul of education, we propose learning objectives that can be integrated across existing curricula. University programs and courses meeting these learning objectives exhibit an emergent property we term TSL.

This model is essentially still a work in progress. In developing TSL, we continue to experiment with it as a means of enhancing its usefulness. Our work to date demonstrates potential in applying this learning framework to courses and programs in higher education. We posit that TSL is a useful framework in that it provides an organizing principle that is simple and effective, and serves to engage and enable participants to explore and enact sustainability. As such, TSL may clarify, elevate and further unify sustainability-oriented pedagogies while strengthening their transformative potential.

Conclusion

While other teaching and learning models cover aspects of cognitive engagement, practical application and emotional connection, TSL offers the organizing model, head, hands and heart (Figure 1), to explicitly unite and embody the theories, practices and heartbeats of sustainability within academic and applied fields. We hope that we have clearly documented the usefulness of the TSL theory, particularly its organizing principle of head, hands and heart, and its application, in the form of the assessment matrix.

We presented an innovative "pedagogical landscape" (Figure 2) and mapped some established inter/transdisciplinary, practical, and place-based sustainability-oriented pedagogies (Table I) by similarity to each other via the simple and effective organizing principle of head, hands and heart. This cognitive landscape clarifies TSL as a valuable bridge amongst sustainability pedagogies. We introduced three case studies that further informed the emergence of the TSL pedagogy to provide additional insight and examples to those interested in planning, implementing and evaluating TSL in various learning environments. Finally, we detailed TSL learning objectives that were developed through study of related pedagogies, and emerged through the case studies.

We presented an assessment matrix (Table II) based on a simple ranking rubric, with a scale from 0-4 to assess the strengths and areas for improvement of TSL programs. TSL is therefore useful for planning, implementing, assessing and reflecting on sustainability-focused post-secondary education.

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