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Teaching for Transformation: (Re)Designing sustainability courses based on ecological principles

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Abstract:

If educators are to effectively prepare learners with the knowledge, skills, and values they will need for creating more sustainable places and communities, a transition must be made from transmissive teaching models to transformative learning processes. But how can courses be designed or redesigned so that they create opportunities for transformational sustainability learning, and how can ecological principles guide this process? The Burns model of sustainability pedagogy provides a practical model for course design that is rooted in ecological principles. The Burns model is comprised of five key dimensions: (1)*Content*; (2)*Perspectives*; (3)*Process*; (4)*Context*; and (5)*Design* and seeks to: (1) increase learners' systemic understanding of complex sustainability issues (*Content*); (2) provide learners with opportunities to think critically about dominant paradigms, practices and power relationships and consider complex ecological and social issues from diverse perspectives (*Perspectives*); (3) enhance learners' civic responsibility and intentions to work toward sustainability through active participation and experience (*Process*); (4) increase learners' understanding of and connection with the geographical place and the community in which they live (*Context*); and (5) utilize an ecological course design process that weaves the other four dimensions together to create transformative learning experiences (*Design*). This design process has the potential to create learning experiences that are transformative and lead to systemic sustainable change.

Key Words: sustainability pedagogy; transformative learning; postsecondary education; course design

In a recent graduate course, I asked students what sustainability issues they were particularly concerned about. Their answers came quickly and were not surprising: climate change, watershed pollution, the state of schools, globalized and industrial food systems, peak oil, and widespread social injustice. Students today are deeply concerned about the state of our world and have a great deal of knowledge about the ecological and socio-cultural problems we are facing. Sustainability education typically focuses on critically examining information about the myriad of problems that exist, and exploring

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possible sustainable solutions to these problems. However, students very quickly become disenfranchised if the process of sustainability education does not prepare them *how* to engage in these complex issues and become problem solvers and change agents. Since sustainability is rooted in deep ethical and spiritual commitments (Hawken, 2007), postsecondary educators need to find ways not only teach sustainability, but to do so in a way that acknowledges the personal and collective transformation inherent in sustainability work.

Postsecondary educators can (re)design courses that prepare students how to make decisions, participate in collaborative leadership, and create systemic solutions to meet the urgency of increasing global and local sustainability challenges (Chambers, 2009). But perhaps even more importantly, priority must be given to transformative sustainability learning that prepares graduates with the new ways of knowing and being human that sustainability requires (O’Riordan & Voisey 1998).

David Orr (2004) argues that we need “education that prepares people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics” (p. 27). Instead, traditional teaching and learning in universities largely ignores ecological principles, and prepare learners to be successful in unsustainable cultural systems, thus perpetuating these systems. Teaching sustainability will require relying less on information transmission and more on transformational learning that incorporates community contexts (Cress, 2004). Teacher-centered and transmissive models of education are not sufficient for teaching sustainability issues because of their complexity and deeply challenging nature (Sterling, 2002).

Sustainability education that aims to be transformative requires a shift toward reflective-learning, problem-based learning and collaborative group work because these pedagogies focus on learning through inquiry, experience and reflection (Moore, 2005). Further, best practices in adult education show that adults learn best when engaged in learning through relationships, dialogue and direct experience (Vela, 1994; Knowles, 1970). Sustainability education within postsecondary settings should build on best-practices in higher education such as experiential learning, service-learning, project-based learning and active learning (Allen-Gil, Walker, Thomas, Shevory, & Shapiro, 2005). Alvarez and Rogers (2006) argue for teaching sustainability as discourse, allowing students to be confronted with complexity and to address the multiples ways that sustainability is interpreted and developed in real lives in a specific place. In order for sustainability to make a real difference in students’ lives, a change in educational culture toward systemic, connective and ecological ways of learning is necessary (Sterling, 2002).

Although we know something about what sustainability education should look like, there is very little theory or research that explores *how* to develop or implement sustainability pedagogy that is indeed systemic, connective and ecological. In particular, research that is focused on teaching sustainability at the postsecondary level is very limited and remains rather conceptual. The research in this area does not indicate much about how sustainability pedagogy is designed or implemented, and whether or not learners actually become prepared to take action to address sustainability challenges in their communities. However, it is imperative that postsecondary learners be prepared with the knowledge, values and skills to be able to contend with the pressing and complex ecological and social problems in the places where they live and work. There is

therefore a need for sustainability pedagogy that can be widely and effectively implemented in various postsecondary settings.

What then might this sustainability pedagogy look like? How can educators design transformative sustainability courses that prepare learners to create positive changes for local communities and ecosystems? Where do educators start in the somewhat overwhelming task of teaching sustainability transformatively? How can ecological principles serve as a guide in this process? The Burns Model of Sustainability pedagogy (Burns, 2009) builds on postsecondary trends toward transformational learning, but contributes a much needed comprehensive approach for designing or redesigning sustainability courses based on ecological principles. This article provides an overview of this model, its dimensions, and applications to course design. An ecological course design process is provided, and ecological principles that guide this design process are described. The aim is to provide practical ways, based on ecological systems, for designing postsecondary sustainability courses that encourage transformative learning.

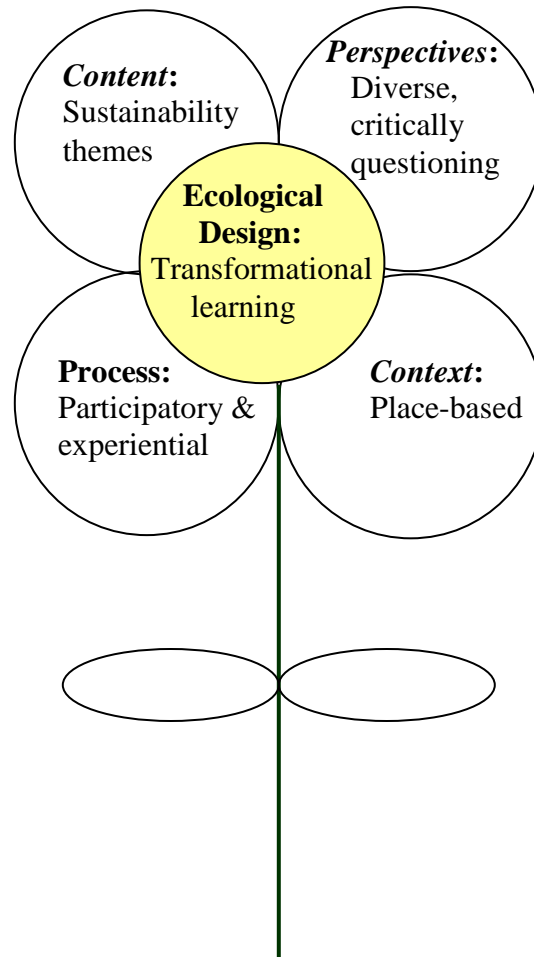
The Burns Model of sustainability Pedagogy:

The Burns model is an ecological teaching *Design* that brings together *Content* that is thematic and multidisciplinary, *Perspectives* that are diverse and critically question dominant paradigms and practices, a *Process* that is participatory and experiential, and a *Context* that is place-based (Burns, 2009). See figure 1. *The Burns model of sustainability pedagogy* builds on the theory and practice of sustainability education to provide educators with an ecologically-based framework for designing holistic sustainability courses and programs with the purpose of transformation, and based on research is an effective tool for doing so (Burns, 2009b). This sustainability pedagogy model holds multiple goals for learners. It seeks to: (a) increase learners' systemic understanding of complex sustainability issues (*Content*); (b) provide learners with opportunities to think critically about dominant paradigms, practices and power relationships and consider complex ecological and social issues from diverse perspectives (*Perspectives*); (c) enhance learners' civic responsibility and intentions to work toward sustainability through active participation and experience (*Process*); (d) increase learners' understanding of and connection with the geographical place and the community in which they live (*Context*); and (e) utilize an ecological course design process that intertwines the other four dimensions to create transformative learning experiences (*Design*).

The central goal of the *Burns model* is to promote transformative learning for sustainability. Mezirow (2000) describes transformational learning as a process by which "we transform our taken-for-granted frames of reference...to make them more inclusive, discriminating, open, emotionally capable of change, and reflective so that they may generate beliefs and options that will prove more true or justified to guide action" (p. 7-8). Other aspects of transformational learning include becoming conscious of how social structures are oppressive, sense-making within a holistic and contextual approach, and a spiritual dimension of soul-based learning (Dirkx, 1998). One of the most clear underlying assumptions of sustainability learning is to understand that our taken for granted perspectives and mind-sets are too narrow (unsustainable), and to generate new

beliefs that guide sustainable action. While this is an individual process of transformation, it may also lead to community transformation.

Figure 1. The Burns model of sustainability pedagogy.



Organic Nature of Classrooms, Communities and Campuses

The ultimate purpose of the *Burns model of sustainability pedagogy*, therefore, is to serve a tool for designing education that empowers and inspires learners to be able to solve complex problems and make changes that regenerate and sustain places and communities (Burns, 2009).

Dimensions of the Model: Content

The first goal of the *Burns Model of Sustainability Pedagogy* is to: increase learners' systemic understanding of complex sustainability issues (*Content*). Sustainability must be addressed multidimensionally in order to take into account systemic relationships between the biological and cultural dimensions of life. Since sustainability is concerned with recognizing relationships, patterns and dynamics, learners must be introduced to a holistic non-fragmented understanding of pertinent issues.

While the disciplinary nature of most postsecondary education is a challenge to using a multidisciplinary approach, the goals of the *Burns model* can initially be achieved by structuring *Content* around a salient sustainability theme(s) within an existing course. Choosing a thematic approach can be an effective way to teach sustainability in a multidisciplinary way. For example, the theme of stream restoration in geography courses have focused on sustainable relationships between people, places, and environments (Moran, 2002).

Education for livable cities has also been used as a theme in which students explore sustainability through personal experience, observation, action and reflection (Pruneau, McLaughlin, Langis, & Gravel, 2002). A livable cities theme could be applied within a variety of disciplinary courses with emphasis on elements such as transportation, energy use, housing, community building, watersheds, or land use. The food system can also be used to teach sustainability within a wide array of disciplines (Harmon, 2002) such as English, Economics, or Sociology.

Sustainability *Content* may be applied to a course in any discipline, using a sustainability theme that is applicable to the discipline or course. However, in the *Burns model of sustainability pedagogy*, the *Content* is just one element of five. Rather than simply providing information about sustainability, or tacking sustainability *Content* onto other disciplinary content, whatever is to be learned about sustainability will be accomplished in relationship with and through the other dimensions of the pedagogy including the *Perspectives, Processes, Context, and Design* of the course. While the learning objectives of a course may contain specific sustainability *Content* (information, issues, perspectives, beliefs, skills, and values to be gained), this *Content* cannot be separated from the other elements of the pedagogy.

Furthermore, effectively reorienting a course to incorporate sustainability *Content* will require an educator to begin with what learners already know and believe about sustainability, and then help them to build a stronger understanding of sustainability issues. In order to learn new *Content* related to complex sustainability issues, learners must be able to connect new knowledge to previous understanding, and construct new meaning within a complex socio-cultural discourse. Sustainability *Content* is thus constructed within relationship to other learners. These relationships will, in turn, challenge students' current views and help them to be able to consider multiple *Perspectives* on sustainability issues.

Dimensions of the Model: Perspectives

The second goal of the *Burns Model of Sustainability Pedagogy* is to: provide learners with opportunities to think critically about dominant paradigms, practices and power relationships and consider complex ecological and social issues from diverse perspectives (*Perspectives*). When incorporating sustainability *Content* into a course,

diverse *Perspectives* should be included in order to provide multiple ways of understanding a sustainability issue. Incorporating a variety of perspectives should include the questioning of and reflection on dominant ways of seeing the world. Cortese (2005) argues that it is important for learners to reflect on the systemic causes of unsustainable practices, and to make visible the physical, social, ecological and economic impacts that are often largely left invisible. By questioning and examining dominant attitudes and behaviors, learners may recognize that many aspects of sustainability crises are cultural in nature (Bowers, 1999). Questioning and critiquing the underlying cultural assumptions and economic and power relationships that create unsustainable and harmful practices is an essential *perspective* to be included in sustainability education.

For example, if the theme of global warming was used within a Sociology course to teach sustainability, it would be important to reflect on dominant systems such as driving cars, the global production and shipping of food and goods, and coal-burning energy production which contribute to global warming. These systems, while causing major ecological damage, require cultural acceptance and daily participation by millions of people. Learning about global warming would require examining the underlying causes and assumptions of dominant patterns and practices such as reliance on continual economic growth, nonrenewable resources, and the maintenance of huge social inequities. Learning about global warming would also include listening to *Perspectives* that provide alternatives to these dominant practices. This may include inviting speakers such as a bicycle transportation advocate, or a business owner of a service or product that is produced locally and sustainably. Visiting an alternative energy project such as a wind farm or even a small-scale project such as a home with a micro-hydro turbine or solar panels would provide another *Perspective*.

In order to question assumptions and power relationships, it is important for learners to be introduced to and consider a variety of diverse *Perspectives*. Sustainability problems are complex and not easily understood from a single perspective. Many *Perspectives* are needed in order to interpret the information, and there is no single right answer. Dresner and Seamans Blatner (2006) posit, “problems possess multiple solutions and multiple criteria for evaluating possible solutions, and require students to engage in a cycle of problem definition, redefinition, and using multiple problem representations” (p. 214). This requires learners to identify multiple stakeholder *Perspectives*, positions, and preferred solutions. Cortese (2005) suggests that including a variety of less-heard *Perspectives* including intergenerational, multi-cultural, local and ecological *Perspectives* are crucial to the process of understanding local sustainability issues. Considering diverse *Perspectives* can also be applied within the classroom, where there may be diverse learners who can provide unique and underrepresented *Perspectives*.

Incorporating diverse *Perspectives* into a course may be accomplished in a variety of ways. For example, in a business course that is using the theme of sustainable entrepreneurship, students could be introduced to a variety of *Perspectives* through guest speakers including people who started sustainable business, an indigenous craftsman or artist, or an elderly person experienced in sustainable household economies. Hearing from a variety of *Perspectives*, especially those that are not typically heard in academia, allows learners to gain a broad understanding of sustainability.

Dimensions of the Model: Process

The third goal of the *Burns model of sustainability pedagogy* is to: enhance learners' civic responsibility and intentions to work toward sustainability through active participation and experience (*Process*). In this model, *Process* signifies opportunities for direct participation and experiential learning. In adopting thematic sustainability *Content*, and by challenging dominant assumptions and power structures and considering diverse *Perspectives*, sustainability pedagogy is inherently focused on change, and making change requires engagement with one's self, with others, and with places. Within a sustainability paradigm, change is viewed as finding new ways (or adopting more traditional ways) of living and working so that human systems are in harmony and balance with ecological systems. This change will require a transformational learning *Process* that will prepare students to take action for sustainable change (Burns, 2009).

Sustainability pedagogy should emphasize active, experiential, and participatory learning (Cortese, 2005). Participatory learning can be empowering and can help learners build the capacity and power to confront sustainability problems (Serrano, 2000). This capacity building and empowerment can be specifically expressed as increasing learners' civic responsibility and desire to work for sustainability. However, gaining these values is a *Process*.

As Kaza (1999) notes, learners in postsecondary education today often experience despair, denial, and self-absorption when exposed to facts about socio-ecological problems, and this is not enough to inspire action for social change. Learners must also have the opportunity to engage in the issues, and actively participate in transforming their world (Kaza, 1999). Service-learning, due to its participatory and experiential nature with goals of civic engagement and leadership, serves as an excellent application of sustainability pedagogy (Burns, 2009). Service-learning integrates meaningful community service with instruction and reflection, and serves to enhance both the learners and the service site. Steinke, Fitch, Johnson and Waldstein (2002) explain that service learning may be a particularly effective way to develop a sustainable democracy that is dependent on the active engagement of an enlightened citizenry.

Participation in the sustainability *Process* should include the opportunity for learners to participate in sustainable practices in local communities, in their own lives, and on postsecondary campuses (Cortese, 2005). The importance of active participation for change implies that sustainability pedagogy must be situated within its immediate context. The civic responsibility that may evolve from sustainability pedagogy can be a natural extension of learners' relationships within the places and communities where they live.

Opportunities for participation and direct experience should be incorporated into courses that focus on sustainability. For example, visits to a particular site such as a riverbank, a farm, a park, an office, a social service agency, or even a grocery store can serve to give students direct interaction with the issues they are learning about. In a course with a sustainable food systems theme, a food-inventory shopping activity in a grocery store can reveal much about the availability (or lack) of local food, and the cost of feeding a family of four on a minimum wage job.

In a course with a sustainable watersheds theme, a visit to a parking lot with bioswales, and to one without, can provide an experiential example of how rainwater is viewed as a resource and how rivers can be stewarded. Science and math classes with

sustainability themes could incorporate active participation in campus gardens, or in biofuel development projects. Marketing courses could include projects in which students research and promote information about sustainable living. English or Communication courses could incorporate projects in which students interview people within local organizations that are working for sustainability and write essays or create presentations about these agencies. All of these options may include valuable opportunities for creative thinking and problem-solving in small groups.

A participatory, experiential learning *Process* is a key dimension of the *Burns model of sustainability pedagogy* because this *Process* prepares learners with skills, values and relationships that can only be developed through direct participation.

Dimensions of the Model: Context

A fourth goal of the *Burns Model of Sustainability Pedagogy* is to: increase learners' understanding of and connection with the geographical place and the community in which they live (*Context*).

Context is central to thematic sustainability *Content*, critical questioning and understanding diverse *Perspectives*, and the *Process* of active learning, and is thus an essential dimension of the *Burns model*. In order for engagement to take place, effective sustainability pedagogy must be rooted in the place where learning is happening. Therefore, the *Context* of sustainability is critical. According to Cortese (2005) the goal of sustainability education is working towards healthy, socially vibrant, economically secure and environmentally sustainable places. Place-based learning is therefore an application that specifies the importance of *Context* (Burns, 2009).

According to Sobel (2004), place-based learning focuses on “how the local landscape, community infrastructure, watersheds, and cultural traditions all interact and shape each other” (p. 9). Orr (1992) explains that this integration of place into education is important for several reasons. First, it requires the combination of intellect with experience, allowing learners the opportunity for direct observation, investigation and experimentation essential for the development of the whole person. Second, place-based education helps to mitigate the problems of overspecialization and the division of subjects into disciplines because it focuses on understanding interrelatedness. Orr (1992) comments, “places are laboratories of diversity and complexity, mixing social functions and natural processes” (p. 129). Another advantage of the study of place lies in reeducating people in the art of living well where they are, in learning to be an inhabitant of a place from which an organic reciprocal relationship with place can grow. Orr (1992) puts it this way, “knowledge of a place - where you are and where you come from - is intertwined with knowledge of who you are. Landscape, in other words, shapes mindscape” (p. 130). Place-based education not only helps learners understand who they are, but to value the places they live and thus to value themselves within that place. In addition, place-based learning not only actively connects learners to the local community (Sobel, 2004), but provides a way to explore and question economic, ecological, social and political relationships through the lens of local places.

The dimension of *Context* can be incorporated into a postsecondary course focused on sustainability. For example, within a statistics course using a sustainable communities theme, students could use statistics from their own community to examine income levels in various neighborhoods and make connections to sustainability issues

such as watershed health, local food accessibility, or waste disposal. Students could also create and analyze their own statistics through the development and dissemination of a survey tool focused on a particular sustainability issue in their community. In a nursing course, students could research and make presentations about sustainable health related resources in various neighborhoods such as community centers, community gardens, walking trails, clinics, natural food co-ops, and yoga or meditation centers. In an economics course, students could learn about small-scale sustainable economies that operate around the world and how these are being applied or might be applied within their bioregion.

The capacity to learn in *Context* helps bring together sustainability *Content*, multiple *Perspectives*, and an active learning *Process*, all rooted within a specific place, adding layers of meaning and understanding to transformative sustainability learning.

Dimensions of the Model: Design

The fifth goal of the *Burns Model of Sustainability Pedagogy* is to utilize an ecological course *design* process that intertwines the other four dimensions to create transformative learning experiences. An ecological course *Design* links the other four dimensions of the *Burns model of sustainability pedagogy* with the purpose of creating learning that has the potential to transform learners' attitudes and values, and ultimately to transform unsustainable systems within unsustainable cultures. The intention is that students become empowered and transformed when learning in a way that is thematic, critically questions dominant norms and incorporates diverse perspectives, is active and participatory and is grounded in a specific context. The intentional and purposeful weaving of these elements together into a course, constitutes its design.

Ecological *Design*, according to Hemenway (2000), includes five basic steps: (1) observation; (2) visioning; (3) planning; (4) development; and (5) implementation. These steps are not necessarily linear, however, and any steps can be revisited throughout the process of designing and implementing a postsecondary course. While this general design process was originally intended for creating a permaculture garden, the process can usefully be adapted to sustainability teaching and learning. The practice of permaculture focuses on mimicking patterns and relationships in nature to create permanent and sustainable culture (Holmgren, 2002). This course design process applies the lessons of ecological principles. When applied to the context of teaching, ecological principles can be valuable guides that can show us how to create social and cultural systems that are resilient and sustainable.

Design Step 1: Observation

In the first design step, observation, it is important to consider a number of factors: What elements are available to work with and what are the conditions and constraints? This is the stage in which an educator may consider what salient sustainability theme could reasonably be incorporated into a course. This includes considering what community and campus resources can be integrated, and what constraints might apply to implementing this theme (Burns, 2009).

The observation stage of design is linked to the ecological principle, "Observe and Interact" (Holmgren, 2002). A process of continuous observation helps in recognizing patterns and appreciating details, and this, according to Holmgren is the

foundation of understanding and design. Natural systems thrive on patterns and relationships. The permaculture phrase “the problem is the solution” is also helpful in recognizing the need to slow down and observe relationships. An open inquiring attitude to problems may be more fruitful than an immediate demand for solutions (Holmgren, 2002). In course (re)design, this may begin with thoughtful observation of the educational institution and its people. Who are the students? What is the climate/culture of the institution and its surrounding community? Who and what are the resources in the area of sustainability? What is already happening in this realm? Over time and through thoughtful observation, the design can evolve based on the needs and the resources available. Developing a course that addresses sustainability too shallowly may fail to meet local needs. Creating an asset map, lists, or charts may be helpful. What resources are readily available? What are the particular strengths of the educator and what areas may require additional outside resources?

Design Step 2: Visioning

The second design step, visioning, considers what the design should do. What should it accomplish and how should it feel? Considering the learning goals of the *Burns Model of sustainability pedagogy* and considering the most important outcomes of the course may be helpful in this stage. In this step, it will also be important to solidify a vision for which sustainability theme will best weave together the course goals. Envisioning opportunities for relationship building between learners and envisioning the tone of the course are also important. Most importantly, the design should include visioning around what kind of transformative learning will take place.

The visioning stage of design is linked to the ecological principle: Life builds from the bottom up (Hawken, 2007). A tree doesn't become a tree overnight, but rather starts as a seed, then a shoot, then grows roots and eventually branches and leaves. Complex organisms are created from cooperating communities of cells (Hawken, 2007) that work together to create a whole, just as a complex course design is comprised of many cooperating parts. In starting with a central vision or intention for what will be created and what kind of transformation may take place, the details of a course design can grow naturally from the bottom up.

Design Step 3: Planning

The third design step, planning, involves asking, what is needed to implement ideas? How should the pieces be assembled? At this point the educator can consider what texts, community resources, field visits, speakers, classroom activities and assignments can be incorporated into the course in order to effectively teach sustainability through the chosen theme. Community projects can be carefully chosen for proximity, applicability, and time/energy of the community organization. This step is a good place to begin a detailed consideration of how to incorporate diverse perspectives, critical questioning of dominant paradigms and power relationships, active participation and direct experience, and place-based understanding (Burns, 2009).

The planning stage is linked to the ecological principle, “Integrate rather than Segregate” (Holmgren, 2002). In natural systems, connections and relationships between organisms are as important as the organisms themselves. Each element of a natural system performs multiple functions and each function is supported by many elements

(Holmgren, 2002). In course design, it is essential to create systems that are closely integrated and to “stack functions.” This refers to the use of one element for many uses. For example, a small group assignment may serve as a way for students to learn about diverse perspectives by volunteering together at a local sustainability organization. At the same time, students may be learning how to build relationships and solve problems in groups, and learning how to think critically about sustainability issues. Creating relationships between all aspects of a course mimics the synergistic relationships in nature and provides learning opportunities that are meaningful and potentially transformative.

Design Step 4: Development

The fourth design step, development, focuses on how the design will be implemented. This stage involves making decisions about assignments and learning activities. It also involves writing a syllabus that reflects the ecological design of the course and the chosen sustainability theme. Will there be weekly themes? Will all learning activities center around one main project, or will there be multiple projects? How will the learning be structured and sequenced?

The development step is linked to the ecological principle that life tends to optimize rather than maximize (Hawken, 2007) and always obtains a yield (Holmgren, 2002). Natural systems tend to develop in ways that promote balance, without excessive accumulation. Yet, at the same time natural systems obtain yields. Plants produce seeds for reproduction and to feed other species, but if there are too many plants crammed together, they won't produce as much. The development of a course should optimize learning rather than maximizing, understanding that in the case of learning sustainability, less can often be more. Obtaining a yield of learning and transformation can be promoted by careful tending and development of learning experiences.

Design Step 5: Implementation

The fifth development step, implementation, involves teaching the course, and in doing so, making adjustments based on further observation, visioning, planning, and development to enhance sustainability learning. Implementing the design also involves assessing whether or not it is flexible enough to meet potential surprises in the classroom. Assessing student learning is an organic learning process for the designer. Assessment provides ongoing opportunities for development of the course, and changes to the *Design*.

The implementation step is linked to the ecological principles that nature works in cycles and uses self-correcting systems of feedback to thrive (Holmgren, 2002; Hawken, 2007). In nature, systems self regulate. The overpopulation of certain species is regulated by predator species or other environmental factors. Cycles of birth, growth, decay, death and rebirth are inherent to natural systems and provide balance to these systems. In a similar way, a sustainability course can incorporate a cyclical design that returns again and again to a central theme. The instructor can apply systems of feedback by doing frequent in class assessment of learning, attitudes and group dynamics.

Conclusion

Applying a design that is based on ecological principles to sustainability courses can provide an opportunity to create a learning system that is resilient and sustainable. The *Burns Model of Sustainability Pedagogy* can serve as a practical tool for

(re)designing sustainability courses with the purpose of transformational learning. Educators can use an ecological design process to create transformative sustainability courses that prepare learners to create positive changes for local communities and ecosystems by incorporating thematic sustainability content, diverse perspectives, an active and participatory learning process, and contextual learning rooted in place. Students' learning experiences must allow them to develop the leadership capacity to be able to understand and address complex sustainability problems holistically, the ability to ask critical questions and understand diverse perspectives, to participate in finding solutions, and to develop personal connections to the places in which their biological, social, and economic lives are grounded. Postsecondary courses that are designed ecologically will allow for learning is connected and systemic, for learning *as* sustainability. In this way, educators can provide opportunities for learners to engage in a learning process that is transformational, and shift toward what Sterling (2002) calls, "learning *as* change...a creative and paradigmatic response to sustainability" (p. 61).

References

- Allen-Gil, S., Walker, L., Thomas, G., Shevory, T., & Shapiro, E. (2005). Forming a community partnership to enhance education in sustainability. *International Journal of Sustainability in Higher Education*, 6(4), 392-402.
- Alvarez, A., & Rogers, J. (2006). Going “out there”: Learning about sustainability in place. *International Journal of Sustainability in Higher Education*, 7(2), 176-188.
- Author. (2009). Skilled in sustainability: teaching sustainability in skills-based courses. In W. Leal Filho (Ed.), *Sustainability at universities: Opportunities, challenges and trends* (pp. 195-206). Frankfurt: Peter Lang.
- Author. (2009b). *Education as sustainability: An action research study of the Burns model of sustainability pedagogy*. (Doctoral dissertation). Portland State University, Portland Oregon.
- Bowers, C. A. (1999). Changing the dominant cultural perspective in education. In G. A. Smith, & D. R. Williams (Eds.), *Ecological education in action* (pp. 161-178). Albany, NY: State University of New York Press.
- Cajete, G. (Ed.).(1999). *A people's ecology: Explorations in sustainable living*. Santa Fe, NM: Clear Light.
- Chambers, D. (2009). Assessing & planning for environmental sustainability: A framework for institutions of higher education. In W. Leal Filho (Ed.), *Sustainability at universities: Opportunities, challenges and trends* (pp. 287-298). Frankfurt: Peter Lang.
- Cortese, A. (2005). Learning principles for sustainability: Sustainability curriculum framework for curriculum development. *Second Nature: Education for Sustainability*. Retrieved December 12, 2005 from <http://www.secondnature.org>.
- Cress, C. (2004). Critical thinking development in service-learning activities: pedagogical implications for critical being and action. *Inquiry: Critical Thinking Across the Disciplines*, 23, 87-93.
- Dirkx, J. (1998). Transformative learning theory in the practice of adult education: An overview. *PAACE Journal of Lifelong Learning*, 7, 1-14.
- Dresner, M., & Seamans Blatner, J. (2006). Approaching civic responsibility using guided controversies about environmental issues. *College Teaching*, 54, 213-219.
- Harmon, A. (2002) Teaching sustainability using the food system as a model. In W. Leal Filho (Ed.), *Teaching sustainability at universities: Towards curriculum greening* (pp. 239-250). New York: Peter Lang.

- Hawken, P. (2007). *Blessed Unrest*. New York: Penguin Group.
- Hemenway, T. (2000). *Gaia's garden*. White River Junction, VT: Chelsea Green.
- Holmgren, D. (2004). *Permaculture: Principles and pathways beyond sustainability*.
Hepburn, Australia: Holmgren Design Services.
- Kaza, S. (1999). Liberation and compassion in environmental studies. In G. A. Smith, & D. R. Williams (Eds.), *Ecological education in action* (pp. 143-160). Albany, NY: State University of New York Press. .
- Knowles, M. (1970). *The modern practice of adult education: An autobiographical journey*. New York: Association Press.
- Mezirow, J. (2000). *Learning as transformation*. San Francisco: Jossey-Bass.
- Moore, J. (2005). Seven recommendations for creating sustainability education at the university level. *International Journal of Sustainability in Higher Education*, 6(4), 326-339.
- Moran, S. (2002) Stream restoration: A senior seminar theme. In W. L Filho (Ed.), *Teaching sustainability at universities: Towards curriculum greening* (pp. 25-44). New York: Peter Lang.
- Orr, D. (1992). *Ecological Literacy*. Albany, NY: State University of New York.
- Orr, D. (2004). *Earth in Mind: On Education, Environment, and the Human Prospect*. Washington, DC: Island Press.
- O'Riordan, T., & Voisey, H. (1998). *The politics of Agenda 21 in Europe*. London: Earthscan.
- Pruneau, D., McLaughlin, E., Langis, S., & Gravel, H. (2002). Education for liveable cities-Environmental and pedagogical actions at the university level. In W. Leal Filho (Ed.), *Teaching sustainability at universities: Towards curriculum greening* (pp.45-60). New York: Peter Lang.
- Serrano, I. (2000). Learning sustainability from crisis. *Convergence*, 33(1), 78-101.
- Sobel, D. (2004). *Place-based education*. Great Barrington, MA: The Orion Society.
- Steinke, P., Fitch, P., Johnson, C., & Waldstein, F. (2002). An interdisciplinary study of service-learning: Predictors and outcomes among college students. In S. H. Billig, & A. Furco (Eds.) *Service learning through a multidisciplinary lens* (pp.72-102). Greenwich CT: Information Age Publishing.

Sterling, S. (2002). *Sustainable education: Re-visioning learning and change*. Devon, UK: Green Books.

Vela, J. (1994). *Learning to listen, learning to teach: The power of dialogue in educating adults*. San Francisco: Jossey-Bass.