

# TEACHING LIVING SYSTEMS AWARENESS AS A CHANGE AGENT SKILL FOR A VIBRANT SUSTAINABLE WORLD

**Barbara Widhalm, Ph.D.**  
3012-A Deakin St., Berkeley, CA 94705

## ABSTRACT

How can we design learning experiences so that they mimic an ecological, living system? How can learners fully *experience* the group as a living, vibrant, organic whole and unleash its creative? The process of stimulating “living systems awareness” and self-organizing creativity in learning communities, such as any courses, workshops, or conferences, is a truly integrative challenge that involves multiple dimensions of learning experience design: how we set up the visible and invisible learning space (structural-spatial dimension), how we pace and allow for flow according to nature’s rhythms (rhythmic-temporal dimension), how we allow for creative expression from the whole person (expressive-extrarational dimension), how we encourage the mind to understand and utilize systems analysis and systems design across disciplines (cognitive-rational dimension), and how we integrate this awareness in our practice (practical dimension). If all these aspects mimic and stimulate living systems dynamics, learners are more likely to co-create life-sustaining ideas, designs and structures. Particularly, there is value in nurturing *autopoiesis* in the classroom, which is a process of self-organizing, self-renewing development in living systems. When a system has a semi-permeable boundary, when there is rich information and resource exchange within that boundary, and when the system draws inspiration from its environment outside the boundary, something new arises that is greater than any participant could have come up with on their own. In order to revert the downward spiral of the industrial growth society, we urgently need to develop a multitude of life-sustaining innovations and regenerative design ideas in education. Because of the fragile state of the planet, an autopoietic approach to teaching is very timely. By integrating living systems awareness through multiple ways of knowing, learners can internalize the principles and processes that sustain all life on earth more fully and are therefore better prepared to take action in an increasingly unpredictable world.

This paper explores how to utilize the principles of living systems as metapatterns to guide instructional design. It summarizes key insights from the author’s recently published dissertation *Nature as Guide to Vibrant Learning*. The author then introduces a series of guiding questions and instructional design examples that allow for the integration of living systems awareness in any project or group process, across multiple dimensions of learning experience design. Particular emphasis is placed on the structural-spatial, rhythmic-temporal, and expressive-extrarational dimension, which deserve much greater attention in education for a healthier world.

**Keywords:** living systems; autopoiesis; sustainability education; transformative learning; multiple ways of knowing; educational systems design

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*Imagine a learning community as a wetland or a forest. Imagine a group of learners as an organic, highly interdependent community, a living system not unlike an ecosystem in nature. Listen to the hustling and bustling of all its life forms; feel the pulsation of this living organism as a whole. Now remember participating in a learning experience that felt particularly vibrant, an experience that had a palpable sensation of aliveness. Remember a time when the group of learners seemed to embody an organic whole, an ecosystem with a life of its own, pulsating with energy and creating something new and exciting, something no single participant could have foreseen or created on his or her own.*

#### **Introduction: The Importance of Nurturing Living Systems Awareness in Education**

All life unfolds according to the same basic principles and processes of organization, called living systems principles (Capra, 1996). These fundamental principles, such as networks, feedback mechanisms, resource cycles, and energy flows, provide an organizing language for ecological communities. Social systems, such as courses, workshops, conferences, and any kind of organization, including educational institutions, are also based on the relational wisdom of nature (Capra, 1996; Booth-Sweeney, 2008). When examining a social system through the lens of life's principles of organization, we can often discover where there are blockages and where the system is not as thriving and alive as it could be. Living systems principles offer key insights into creating a sustainable future (Capra, 2009).

The author suggests that teaching living systems principles must become a cornerstone to any instructional design approach for preparing students as change-makers for a healthier world. How, then, should educators teach about living systems? Most importantly, the mind alone is not enough to guide us in applying life's principles of organization to designing a healthier world. We also need to experience these principles with our whole being, including our bodies and hearts. Leading scientists and sustainability scholars increasingly speak to the importance of heartfelt relating. Hawken (2007) states: "To salve the world's wounds demands a response from the heart" (p. 188). Uhl affirms this: "In the end, it is not new laws or more efficient solar cells that will play the leading role in solving humankind's environmental and social problems, it is our awakened and caring hearts. When our hearts awaken, our resolve quickens, our courage grows, our compassion stirs, and our imagination expands" (Uhl, 2004. p. xx).

When we fully understand, perceive, and experience the relational wisdom of nature, with our hearts and our whole being, we are in living systems awareness. Living systems awareness, in other words, refers to a lived experience of life's principles of organization through multiple ways of knowing. When we learn to experience and take action from living systems awareness, we are more likely to become effective change-agents even as life circumstances become more difficult. Educational institutions, which prepare our future decision-makers, must therefore play a key role in nurturing living systems awareness. The author introduces key theoretical concepts and practical guidelines to that end.

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### Nature's Organizing Language as Foundation to Living Systems Awareness

In order to prepare for the educational framework suggested in this paper, it is useful to review the basic organizing principles of life, or living systems principles, more closely. Booth-Sweeney (2008) provides a very accessible definition for living systems:

We use the phrase *living systems* as a metaphor, to represent an animate arrangement of parts and processes that continually affect one another over time. There are living systems on all scales, from the smallest plankton to the human body to the planet as a whole. When we understand what makes up a living system, we can see that a family, a business, and even a country also are living systems. (p. 3)

Living systems characteristics have been broken down into anywhere from four (Macy & Brown, 1998), to six (Capra, 2002), to more than 12 (Booth-Sweeney, 2008) interrelated principles. This paper will utilize Capra's principles as defined for the Center for Ecoliteracy (2011b):

- “Nested Systems: Nature is made up of systems that are nested within systems. Each individual system is an integrated whole and—at the same time—part of larger systems. Changes within a system can affect the sustainability of the systems that are nested within it as well as the larger systems in which it exists.
- Network: All living things in an ecosystem are interconnected through networks of relationship. They depend on this web of life to survive.
- Dynamic Balance: Ecological communities act as feedback loops, so that the community maintains a relatively steady state that also has continual fluctuations. This dynamic balance provides resiliency in the face of ecosystem change.
- Cycles: Members of an ecological community depend on the exchange of resources in continual cycles. Cycles within an ecosystem intersect with larger regional and global cycles.
- Flows: Each organism needs a continual flow of energy to stay alive. The constant flow of energy from the sun to Earth sustains life and drives most ecological cycles.
- Development: All life—from individual organisms to species to ecosystems—changes over time. Individuals develop and learn, species adapt and evolve, and organisms in ecosystems coevolve. (Center for Ecoliteracy, 2011b)

Most importantly, Capra (2009) determined that the characteristics of living systems in nature all have to do with relationships in community. Nature continuously changes,

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unfolds, and develops through its dynamic relational patterns, structures, and processes. Contact and communication between system components and systems are at the heart of life continuing and unfolding, and aid in what is essential to any living system: its capacity to renew itself and develop new complexities, which is the capacity of autopoiesis. These life-giving relational dynamics are not unique to natural systems, they apply to social systems, as well (Booth-Sweeney, 2008; Capra, 1996, 2009; Macy & Brown, 1998). Social systems of any kind (families, organizations, learning communities) unfold and develop through dynamic interactions in continuous feedback with each other.

### Education as Patterning for Life

Living systems principles, such as those identified by Capra above (Center for Ecoliteracy, 2011b), can be considered *metapatterns of nature*. Metapatterns provide rich opportunities for creating a dynamic structure for living systems educational design. The theoretical significance of metapatterns as translating inherent life wisdom into educational design practices has been discussed by Volk and Bloom (2007a, 2007b) and was originally inspired by Bateson (2002) who coined the term “the pattern which connects” (p. 7) in the late 1970s.

Volk and Bloom (2007a, 2007b) defined metapatterns as follows:

Metapatterns are broad, overarching patterns that span multiple contexts (e.g., academic disciplines, cultures, personal experiences, etc.), and are transphenomenal and transdisciplinary . . . Although context-specific meanings of each metapattern may differ, the essential core meanings or functions are shared across such contexts. (Volk & Bloom, 2007b, p. 46)

Volk and Bloom further stated, “metapatterns provide a framework for exposing interactions among patterns of cognition, discourse, culture, organization, physical and social environments, and other contexts” (Volk & Bloom, 2007b, p. 49). They maintained that “metapatterns can serve in the process of learning as templates for understanding systems on a number of different scales, and thus for making connections between these scales” (p. 37).

Bateson (2002) emphasized that patterns are not fixed, they are a dance of interacting parts. This realization is crucial for the framework proposed in this paper.

We have been trained to think of patterns, with the exception of those of music, as fixed affairs. It is easier and lazier that way but, of course, all nonsense. In truth, the right way to begin to think about the pattern which connects is to think of it as *primarily* (whatever that means) a dance of interacting parts and only secondarily pegged down by various sorts of physical limits and by those limits which organisms characteristically impose. (p. 12)

Ecopsychologist Fisher (2002) proclaimed the need for awakening *unactivated interactional patterns* as an essential recollective practice needed for the healing of

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people and the planet. In education, the author suggests, there are layers of unactivated interactional patterns that are repressed, untapped, or not cultivated enough. There is a disconnect if the learning modality embodies a traditional hierarchical structure (lecture, conference presentation, panel with questions and answer) while the content explores decentralized, pluralistic, highly interdependent dynamics. Similarly, there is a disconnect if the learning or conference modality is limited to a cognitive-rational mode of relating dominated by verbal dialogue, while the dynamics of life and vibrancy inherent in sustainability call for us to become engaged as whole, vibrant beings prepared to protect life on Earth. Thus, participants experience an incongruence, or, at the very least, a *pattern-poor* rendering of the topic.

What if education were designed according to patterns of nature, in an organic dance of patterns that connect (Bateson, 2002)? What if education's primary mission were to reactivate unactivated interactional patterns (Fisher, 2002)? The author suggests that by utilizing living systems principles in transdisciplinary ways across scales and multiple contexts, as Volk and Bloom suggest (2007a,b), there is great potential for integrating and deepening living systems awareness across multiple dimensions of knowing and learning experience design.

### **Patterning for Design for Autopoiesis**

Nature's pattern dance is designed in ways that allow for self-organizing, self-renewing developments within structures and processes described by nature's pattern language and organizing principles. This emergent process is often referred to *autopoiesis*. Capra (1996) defined autopoiesis as a "network pattern in which the function of each component is to participate in the production or transformation of other components in the network. In this way the network continually makes itself. It is produced by its components and in turn produces those components" (p. 162). Capra further defined the following properties of an autopoietic network, drawing on Maturana and Varela (1991):

- *Self-bounded*: The boundary is an integral part of the network. The system is organizationally closed but open with regard to flow of energy and matter. Its order and behavior are not imposed by the environment but established by the system itself.
- *Self-generating (self-renewal) and self-perpetuating*: All components, inclusive of the boundary, are produced by processes within the network. Production processes continue over time, so that all components are continually replaced by the system's processes of transformation.
- *Structural coupling*: New structures are created in interaction with the environment, which results in continuing adaptation, learning, and development.

The three characteristics of autopoiesis—self bounded, self-renewing, and structural coupling—are critical in the context of designing learning experiences for education for a healthier world. An educational system (class, workshop, conference, or university as a

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whole) that is alive similar to an ecosystem will develop strong but permeable boundaries (“bounded”), build intricate networking capacities among its participants, and catalyze participants’ growth and development (“self-generating”), and will allow for a continuous exchange with its environment for cross-pollination and development of new insights (“structural coupling”). Living systems are learning systems (Capra, 2009). They learn through the process of autopoiesis, by integrating lessons learned with new stimuli to create conditions for emergent developments. It is therefore very appropriate to apply principles of living, learning systems to the context of learning communities as living, learning communities. Autopoiesis, regardless of its literal translation as “self-making,” is, in its very essence, an “each-other-making” and “us-making” process.

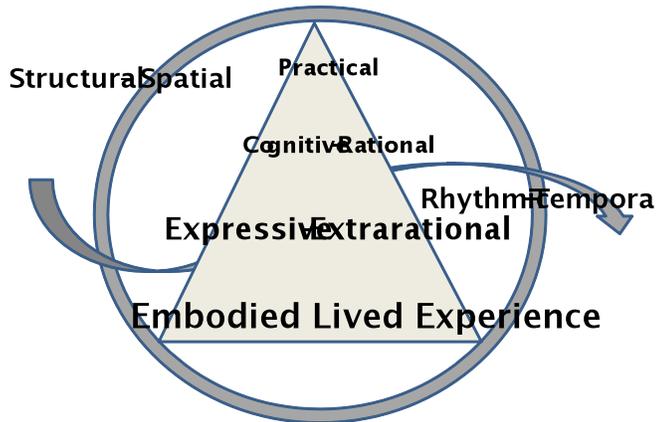
When an educational system has a semi-permeable boundary or “membrane,” when there is rich engagement and information exchange among learners within that boundary, and when the learning community draws inspiration from its environment outside the boundary, something new is likely to arise that is greater than any participant could have come up with on their own. In order to revert the downward spiral of the industrial growth society, we urgently need to develop a multitude of life-sustaining innovations and regenerative design ideas in education. Because of the fragile state of the planet, an autopoietic approach to educational design is very timely.

### Dimensions of Learning Experience Design

This paper proposes that designing learning experiences in congruency with life’s principles of organization involves intentionally engaging multiple dimensions of learning experience design: how we set up the visible and invisible learning space (*structural-spatial dimension*), how we pace learning components and allow for flow according to nature’s rhythms (*rhythmic-temporal dimension*), how we allow for creative expression in learning (*expressive-extrarational dimension*), how we encourage the mind to understand and utilize systems analysis and systems design across disciplines (*cognitive-rational dimension*), and how we integrate this awareness in our practice (*practical dimension*). If all these dimensions mimic and stimulate living systems dynamics, learners are more likely to co-create life-sustaining ideas, designs and structures.

Drawing on these five dimensions, as well as on transformative learning scholars Heron (1992), and Yorks and Kasl (2002, 2006) who describe a pyramid of multiple ways of knowing that is grounded in direct experience, the author offers an integrated model illuminating multiple dimensions of learning experience design (see Figure 1 below): Life, or embodied, lived experience, lies at the very foundation of knowing, informing, through expressive-extrarational “osmosis,” the cognitive-rational and practical dimensions of knowing. In addition, the structural-spatial dimension describes all the visible and invisible space considerations of a learning experience, including the room setup and constellations of physical and virtual individual and group learning spaces with various degrees of planned and open-ended structure. The rhythmic-temporal dimension pertains to the timing and pacing of a learning experience, including time allocated for active as well as slower, integrating times.

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**Figure 1. Dimensions of learning experience design.  
(Figure created by author)**

Each of these dimensions deserves consideration in learning experience design, be it a conference, workshop, or course. Heron's (1992) pyramid is used in the center in Figure 1 to illustrate the importance of grounding learning in lived experience and giving significant weight to the expressive-extrarational realm of learning experience design. Extrarational expression can include a variety of modalities that connect learners with the wisdom of the body, heart, and soul, such as story-telling and acting, visual or plastic arts, movement, music, or mindfulness practices. By tapping into lived experience via expressive-extrarational ways of knowing, the quality of cognitive-rational and practical learning is greatly enhanced. The rhythmic-temporal and structural-spatial dimensions are important to take into consideration when emulating the structures, patterns, and rhythms of a living system. The researcher maintains that if a learning experience mimics the structures and rhythms of a living system, the experience invariably begins to feel more alive and vibrant. Among the dimensions of learning experience design included in this model, cognitive-rational learning remains higher education's stronghold and is, to some degree, complemented by practical knowing in sustainability education (such as project-based learning and service learning). This model illustrates that cognitive-rational and practical ways of knowing are only the tip of a more holistic learning pyramid. In order to prepare change-agents in an increasingly unpredictable and emotionally challenging world, educators must begin to integrate these other dimensions, as well. Only then will learners be able to fully embrace living systems awareness.

### **Metapatterns of Nature as Foundations of Learning Experience Design—Membranes and Patterns that Connect Organically**

A literature review of transdisciplinary literature on transformative learning and education, ecopsychology, systems-based group facilitation, and indigenous ritual design (Bache, 2008, Brown, 2005, Daloz, 2004, Dirkx, 1997, 2001; Ferrer, Romero, and Albaredo, 2005, Fisher, 2002, Heron, 2009, Hill, 2004, Lange, 2009, O'Sullivan, 2004, Palmer 2007, Somé, 1999, Yorks & Kasl, 2002, 2006), has prompted the author to

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suggest two overarching metapatterns for an initial design framework toward vibrant learning experiences: membranes, and patterns that connect organically. Integrating the above discussions on metapatterns, living systems principles and autopoiesis, and dimensions of learning experience design, the author offers a description of each metapattern, both from an ecological perspective and an educational design perspective. Then, guiding questions, examples, and implementation ideas for applying these metapatterns of nature to learning experience design for a healthier world are introduced.

### *Membrane*

A membrane is a permeable boundary that gives a living system a distinct place to be and evolve. It controls what kind of energies and nutrients migrate across the boundary. It allows for a space nested within larger spaces that also have membranes, nested within yet larger systems and so on. Cell biologist Lipton (2008) considers the membrane a critical aspect of genetic development and evolution, more significant than the DNA. Evolution is a function of co-creation. Structural coupling, in systems terms (Capra, 1996), and symbiogenesis, in evolutionary biology terms (Margulis, 1999), also speak to the phenomena of development and the emergence of new structures happening as a result of membrane-facilitated changes in co-creation with the environment. In social systems, a membrane creates a sense of safety, identity, and belonging to a whole distinct from, yet interconnected with, other wholes. The membrane is a container that can only exist in community. A teacher alone cannot create the membrane. It needs witnesses, peers, places in which learners have the opportunity to be seen and to see. An intentional creation of a membrane creates a field that is fertile for transformation.

Creating a sense of membrane goes beyond dedicating space and time to meet as a group, however. There are plenty of unused and underutilized membranes in nearly any academic learning experience. Every conference that starts and ends with a series of speeches and neglects the opportunity to invoke a participatory ritual of belonging, for example, leaves its membrane potential un-activated.

### *Patterns That Connect Organically*

Within the membrane, system components engage in different patterns of relating. In any living system, continuous flows of information, energy, and nutrients are exchanged in a dynamic balance of giving and receiving through intricate feedback loops. They form a complex network of relationships, from the cellular to the global level. Creativity happens at what the author calls “living edges,” at the places where one or more components interact. In nature, some of the patterns that connect can be seen, such as meanders in streams, ripples in a lake, branching patterns in trees, network patterns of a spider web, spirals in snail shells, or honeycomb patterns. Underneath are also countless intricate unseen patterns of relating, patterns of energy and information, and chemical exchanges on molecular and cellular levels. This movement is not controlled by a single entity, it continually self-organizes. This phenomenon has also been recognized as vital for the health of the growing decentralized but highly networked grassroots movement to support a life-sustaining society (Hawken, 2007). Patterns that connect are not fixed. They are always in motion, flux, and ever changing. Patterns connect in a dance (Bateson, 2002). Creating patterns that connect, therefore, goes beyond providing for an

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alternation of large group and small group experiences, or keynote sessions and topic workshops. Critical here is the notion of fluidity, of unpredictability, of change.

Patterns connect in new complexities if they are given time and space to connect, if allowed natural rhythms of gestation and activation, of disintegration and integration, of ebb and flow, of the four seasons. Learning experiences, designed as living systems, need gestating spaces where things are allowed to percolate, jell, simmer, before they can transform. Nature has cycles of day and night and seasons for this process to unfold, and provides countless niches and spaces protected by soil, skin, and bark where components disintegrate and slowly reintegrate.

In higher education, the general tendency has been to only allow for active times that can be measured by learning outcomes and benchmarked with quantifiable assessments (Doll, 1993), and to neglect the slower times in which a deeper level of integration might occur. An educational framework that takes nature's rhythms into account must allow for unstructured times and spaces, as well as semi-structured times catalyzed perhaps only by a question or suggestion without requiring specific outcomes (Ferrer et al., 2005).

Reviewing the key processes of autopoiesis, Table 1 relates these two overarching metapatterns to the primary autopoietic conditions and processes.

**Table 1: Autopoiesis Applied to Instructional Design**

<b>Autopoietic Condition</b>	<b>Educational Design Approach</b>
Bounded	Membrane
Self-Renewing and Structural Coupling	Patterns that connect organically, providing ample opportunities for contact and cross-fertilization within and across the systems boundary while honoring cycles and seasons of development

Thus, the author suggests, an educational design approach according to metapatterns of nature, particularly those that allow for an intentional design of a membrane and multiple patterns that connect organically, is more likely to generate autopoietic developments.

### Metapattern Educational Design Questions for Educators

Below a series of guiding questions and examples for living systems educational design are presented. These questions are not prescriptive. They are not intended as a toolbox or a template for lesson plans. Rather, they tap into the wisdom inherent in patterns of nature and send educators on a pedagogical design journey that is open-ended and intended to invite emergent creativity. The questions and examples highlight opportunities primarily in the expressive-extrarational, structural-spatial, and rhythmic-temporal dimensions of learning experience design, which are the least developed dimensions in higher education.

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### *Membrane Design Questions*

- How can I facilitate a sense of belonging and group identity? How can I create a membrane for my course/workshop/conference?
- What nonrational means am I comfortable introducing to create an energetic sense of belonging? What symbolic, metaphoric, or ritualistic gestures would help me in creating a visible/invisible membrane? What types of nonrational expression will learners be comfortable with initially? What other ways of expressing am I comfortable gradually introducing?
- How can I set up the physical space so it is conducive to creating a membrane effect?
- How can I allocate times at the beginning, end, as well as throughout the course or unit to allow the group energy to be gathered as a whole and sustained?

### *Membrane Design Examples*

- Circular room setup; whole group spaces and functions dedicated to community building (possible also online through virtual café's or spaces for group creative expression).
- Opening and closing rituals, such as creating and taking down an altar; poems; dedications.
- Check-in and check-out times in council style (talking stick, sharing without others commenting—creates group field).
- Intention setting; creation of ground rules.
- Mindfulness practices at beginning and end: meditation, mindful movement; body awareness and scanning.
- Exercises that evoke group consciousness and commitment or group reflection (e.g., Council of all Beings or Grief Mandela as described in Macy & Brown, 1998; group exercises used in permaculture design courses as described in Peck, 2002).
- Icebreakers; collaborative group games.
- Celebrations and acknowledgements (new generations of students, outgoing generation, birthdays).
- Inviting personal or ancestral stories from participants: letting these stories weave together to acknowledge commonalities and differences; aided by symbols, such as objects resembling a piece of participants' past or ancestry.
- Educators can prepare, nourish, and close the group field with their own spiritual and mindfulness practice (see Bache, 2008 [*The Living Classroom*]).

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### *Patterns That Connect Organically—Design Questions*

- How can I facilitate that my course (workshop, conference) mimics patterns that connect in nature?
- Which natural patterns inspire me for the design of this course? (meandering, branching, ripples, honeycomb patterns, web, etc.)
- How can I stimulate “organismically satisfying” contact in my learning context? How can I encourage participants to connect with each other through the heart? From a deep soul-space? What nonverbal modes of communication could be helpful?
- How can I honor the rhythm and pace of nature in the design of learning experiences? How can I design for active times as well as resting, integrating times (within a session, course, program, conference)? How would I allow for this course to evolve through natural cycles and seasons? What rituals could serve in honoring cycles and seasons in the learning process?
- How can I balance structured, semi-structured, and unstructured times to allow for enough time for self-organization and emergence? How can I allow for “open spaces that allow for high levels of uncertainty, ambiguity, contradiction, and paradox” (Dirkx, 1997)? How can I facilitate an agenda that leaves enough room for quality encounters and is not too packed?
- How can I set up the meeting space so that there are ecological niches where people can gather, hang out, and connect?
- How can I facilitate “chance encounters” and the meeting of people that may not otherwise connect through affinity groups?
- How can I set up opportunities for participants to give and receive heartfelt, authentic feedback, and meet as whole persons?
- How can I facilitate cross-fertilization of ideas, people, and resources within and between systems boundaries? How can I facilitate opportunities for creative ideas and insights generated in small groups to be harvested and shared more widely? Cross-fertilization across departments, disciplines, schools? Town-gown partnerships?
- How can I set up ongoing assessment mechanisms of the health and functionality of the learning community as a living system?

### *Patterns That Connect Organically—Design Examples*

- Milling exercise as part of Macy’s *Work that Reconnects* (Macy & Brown, 1998): Participants walk silently through the space, frequently changing direction until the facilitator asks them to stop in front of another person and be present with him/her,

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through eye contact or joining hands. The facilitator then guides these pairs through a nonverbal visualization or meditation in which each partner is asked to get in touch with the other's life experience, including his/her pain for the world, yearnings, and strengths. A different set of qualities is highlighted with each round of milling, increasingly emphasizing the collective energy of both partners and all in the room.

- *Macy's Work that Reconnects* offers many additional exercises stimulating heart-felt relating in pairs and small groups with frequently changing constellations (Macy, 2006; Macy & Brown, 1998). For example, sentence completion exercises with partner changes, with one partner speaking, the other just listening.
- Conversation café (Brown, 2005): Small groups of people gather around café tables to explore questions that matter to everyone present. Participants listen for common patterns and deeper insights. After awhile, participants switch tables, with one participant remaining at the table, sharing the key perspectives of previous discussions, which encourages cross-pollination of perspectives. After several rounds of dialogue, insights are harvested as a whole group. This dynamic approach evokes collective creativity and elicits new approaches to engrained problems. Successfully applied in higher education by Bache (2008).
- Systems games (Booth-Sweeney & Meadows, 2008 [*The Systems Thinking Playbook*]).
- Visual meeting facilitation techniques help draw connections between themes and graphically illustrate the flow and key outcomes of a meeting. There is a group of professionals specifically trained in these techniques (<http://ifvp.org/>). They can be hired to visually document a meeting, conference, or workshop in real-time.
- Open Space group facilitation technology at conferences (without regular conference sessions happening at the same time: <http://www.openspaceworld.org/>). During an Open Space process, participants suggest discussion topics, in lieu of a predefined agenda, and volunteer to be dialogue facilitators on their topic. Meeting locations are assigned to each topic. Participants join the topic of their interest and are free to leave and move to another group at any time. At the end, the group facilitators report out to the whole group.
- Physical setup rich in "living edges" and niches: places to sit and talk, pillows, snacks, places in nature for solitude and communal time; places and times to attune to nature's cycles and seasons.
- Honoring the cycles of nature:
  - Active times (e.g., community engagement, design competitions, grant writing, policy-making, direct actions, celebrations).
  - Integrating times (e.g., journaling; walks in nature; reflections with peer feedback; art; storytelling; drama; meditation; body mindfulness and movement; ritual).

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- Systems games (Booth-Sweeney & Meadows; 2008 [*The Systems Thinking Playbook*]) and case studies (Meadows, 2008; Pauli, 2010; permaculture principles and examples as described in <http://permacultureprinciples.com>; systems resources as listed by Booth-Sweeney in <http://www.lindaboothsweeney.net/resources> or by the Society for Organizational Learning in: <http://www.solonline.org/>) to practice cognitively understanding systems dynamics in different contexts and applying systems principles to real-life projects.
- Networking outside the course: mentors, community partnerships, job-shadowing (practical level of living systems design).

### *Questions Inquiring About Autopoietic Developments*

The researcher postulates that if educators pay attention to the above design principles, autopoietic development will unfold organically and something will take over. At the same time, there will be a palpable sensation felt by some or all in the group that the learning community has become a living organism, that it is pulsating with aliveness. That will be the ultimate indicator of success. To that end, educators are encouraged to periodically reflect if an autopoietic process is unfolding. These questions were developed based on reflections of learning experiences the author has participated in that have felt alive, vibrant, and have resulted in autopoietic developments.

- Are there any new, unplanned developments that have arisen during this learning experience? (connections, relationships, ideas, capacities for empathy and compassion, technologies, designs, calls for action, events, movements). Any positive ripple effects?
- What may have contributed to these developments arising?
- How can we acknowledge and celebrate these developments? How can we continue to nurture them into being and sustain them? Are they beginning to sustain themselves?
- Are group members experiencing a felt sense of aliveness in the group? Is the group becoming comfortable with prolonged periods of “pregnant silence”? Is the group becoming more friendly and imitate with each other? Are group members becoming more comfortable connecting with each other nonverbally?
- Is the group becoming comfortable with giving and receiving authentic feedback, including in areas of difference and conflict?
- Are group members beginning to co-create the learning experience and take co-responsibility for the wellbeing of the group?
- Is the group becoming more adaptable to shifts and unexpected changes? Is the group becoming more comfortable with holding unforeseen developments? Is the group self-organizing?

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If we see a number of these developments unfolding, chances are, we are well on our way of facilitating a learning experience as an autopoietic living system!

As an extension and more detailed elaboration to implementing living systems awareness in education, the author has developed tables mapping Capra's principles of living systems against multiple dimensions of learning experience design (structural-spatial, rhythmic-temporal, expressive-extrarational, cognitive-rational, and practical-applied), providing examples and guiding questions for educational design across each of these dimensions for each of the six principles. Presenting these tables here goes beyond the scope and space allocated for this paper. However, the reader is welcome to look up these tables in Chapter 3 of the author's dissertation (Widhalm, 2011), which is available on-line.

### Conclusion

The earth needs solutions that are autopoietic, solutions that can reverse the downward spiral caused by the industrial-growth-society. Higher education institutions have a core responsibility to become catalysts for the regenerative sustainability revolution ahead. Time is critical to radically ramp up efforts to educate effective change-makers for a sustainable world.

This paper introduced a new framework for designing learning experiences as organic wholes that mimic living systems dynamics across multiple dimensions of learning. It is based on the premise that learners who have developed living systems awareness at a cognitive, as well as heart- and soul-level will be much better prepared to take action.

By integrating living systems awareness through multiple ways of knowing across these dimensions, we can internalize the principles and processes that sustain all life on earth more fully and will therefore be better prepared to take action in an increasingly unpredictable world that requires all the adaptability, agility, and co-creativity we can muster.

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