

Standing in the Crossroads: The Role of Transformative Education in Addressing Sustainability

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Abstract

Today we find ourselves standing in the crossroads of our future. Will we learn from our past mistakes and successes or become yet another story of societal and ecological collapse? As sustainability educators we are called to consider our contribution to education innovation by asking, as does Stephen Sterling (2001), what is education innovation, what is education innovation for and how is educational productivity defined. Our capacity to leverage the knowledge contained in the past and present chronicles of environmental devastation and human behavior lies in how we choose to answer these questions today and into the future. This article explores how complexity, resilience, transformation and regeneration form a transformation pedagogy based in a paradigm of learning as change. This pedagogy underscores the need for systems thinking, paradoxical curiosity, dialectical thinking, and transcendence within an authentic action context as well as the necessity for more aesthetic and spiritual spaces of engagement and connection. This approach to sustainability education is designed to intentionally increase the complexity of our learning environments by creating persistent relational communion platforms that though their adaptation and transformation allow for the emergence of the as-yet imagined—for it is this creative and imaginative capacity that can foster catalytic change; change that moves us from the brink of collapse towards a sustainable future for all.

Key Words: Transformation, Complexity, Resilience, Regeneration, Sustainability, Education

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Jared Diamond, in his book “Collapse: How Societies Choose or Fail to Succeed” (2005) explores how environmental components, the contributions of climate change, and hostile neighbors and trade partners lead to the collapse of societies such as the Maya of the New World and the Norse of Greenland. Diamond identifies eight factors that have historically contributed to the collapse of past societies. These factors include deforestation, habitat destruction, soil degradation, poor water resource management, overhunting, overfishing, invasive species,

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overpopulation and increased per-capita ecological impact of people. While Diamond recognizes that environmental damage is not the only major factor in the collapse of civilizations (the collapse of the Soviet Union a case in point), he underscores that the human capacity to choose lay at the heart of the problem. In his New York Times January 2005 op-ed, Diamond sees us standing at yet another societal crossroads. Our choice this time...will we learn from our past mistakes.

Unlike any previous society in history, our global society today is the first with the opportunity to learn from the mistakes of societies remote from us in space and in time. When the Maya and Mangarevans were cutting down their trees, there were no historians or archaeologists, no newspapers or television to warn them of the consequences of their actions. We, on the other hand, have a detailed chronicle of human successes and failures at our disposal. Will we choose to use it? (New York Times, 2005)

The Maya, Norse and Mangarevans had no chronicles to inform their decisions nor did they have advanced educational institutions to interpret and learn from these chronicles of human successes and failures. Anthropologist and historian Joseph Tainter's (1990) examination of two dozen cases of collapse spanning more than 2,000 years found that societies collapse when their investments in social complexity, such as educational and technological innovation, reach a point of diminishing marginal returns.

Today as we stand in the crossroads of our future we, as sustainability educators, are called to consider our contribution to educational innovation. Stephen Sterling in his book *Sustainability Education: Re-visioning Learning and Change* (2001) explores this question with several others:

- what is education innovation,
- what is education innovation for,
- how is educational “productivity” defined.

Our capacity to leverage the knowledge contained in the past and present chronicles of environmental devastation and human behavior lies in how we choose to answer these questions today and into the future.

At present, education is at risk of becoming Diamond's ninth critical factor of collapse. Yet found within all Diamond's factors of collapse are possible solutions: reforestation, soil restoration, effective water resource management, and population control to name a few. Innovative education is also a solution. This article explores how complexity, resilience, transformation and regeneration help shape what education innovation is and what it is for. It is my hope that this exploration will help sustainability educators create transformative learning contexts and communities that foster catalytic change – change that moves us from the brink of collapse and towards a sustainable future for all.

Reframing the Cross Roads: The Nature of Complexity, Resilience and Regeneration

How we interpret, educate and take action towards environmental and sustainability issues is greatly influenced by the lens we use to observe them. Are we facing a crisis or an opportunity? Is it better to address the underlying local problems or the overarching global issues? Can we distinguish the problem or issue from its symptoms? The past traditions of science and education largely consider these questions by a mechanistic examination of the relationships among the parts or acting agents. Using this reductionist lens, we interpret the whole through the sum of its parts and believe cause and effect relationships are predictable given enough time and resources. Much knowledge was gained using this lens and, despite the view of many critics of this lens, it remains an important tool when used in balance with other ways of knowing. But as Stephen Sterling (2004) states, “We are accustomed to analytic and reductionist thinking which understands things by taking them apart. But in a highly complex and turbulent world, there’s a strong argument that says that analytic thinking is not enough. Indeed, by itself, it is probably increasing our problems (p.iv).”

Complex systems thinking offers a different lens to view our world. This new lens opens us to a world whose whole is greater than the sum of its parts and a world whose interconnections are unpredictable, nonlinear cause and effect relationships. Through this complex systems lens we see a world in the midst of transforming in response to change. Today there is a growing interest in complex systems, as evidenced by the number of papers, websites, disciplines and conferences dedicated to the topic. Studies and applications of complexity are emerging from a wide range of disciplines including physics, biology, economics, engineering, and social science. As we will see this new lens is changing the way we view the world.

The Nature of Complexity:

There is still much discussion on the definition of complex systems, an indicator that the field of complexity and complex systems is itself evolving. Francis Heylighen (2008a) considers the challenge of defining complex systems to be one of the most problematic aspects of complexity. He himself describes complex systems as entangled relationships or agents interacting over time and space in unpredictable ways.

While the definition of complex systems remains unsettled, there are several global features of complex systems that appear across multiple domains. The most prominent two features are self-organization and emergence. Self-organization allows complex systems to spontaneously organize themselves so as to remain resilient to various internal and external disturbances and stimuli. This adaptive quality allows the system to emerge new behaviors in response to a changing environment. The self-organizing and emerging properties of complex systems are responsible for most of the patterns, structures and orderly arrangements that we find in the natural world, and many of those in the realms of mind, society and culture (Heylighen, 2008b).

The general properties of a complex system as currently understood can be summarized by the following:

Complex Systems components themselves are DISTINCT and INTERCONNECT: A complex system consists of many (but not necessarily all) parts that are connected via their interactions. Thus, a complex system is more than the mere sum of its parts. The components of this system are paradoxically both autonomous and to some degree mutually dependent.

Complex systems have FUZZY BOUNDARIES that are OPEN: The boundaries of a system are difficult to determine, thus the decision of what is within and outside the system is ultimately made by the observer. Matter, energy and information flow across these fuzzy boundaries.

Relationships in a complex system are NONLINEAR: In a complex system, the relationship between the causes and the effects are not proportional. A small change within the system may cause a large effect, a proportional effect, a small effect or even no effect at all (where as all linear relationships are proportional, the cause equals the effect).

Relationships in a complex system contain FEEDBACK loops: Feedback loops are chains of events in which an “output” of an initial set of events influences, as input, the next set of events, and the next, and the next—until the initial chain is again impacted. These inputs can have both balancing and reinforcing effects, which are fed back into the systems in such a way that the behavior of the system itself is altered.

Complex Systems are NESTED: The components of a complex system may themselves be complex systems nested within each other at many different levels of scale both physically and spatially (i.e. through space and time).

Complex Systems are SELF ORGANIZING: The internal organization of a system, through the processes of positive and negative feedback, increases in complexity without being guided or managed by an outside source.

Complex Systems have EMERGENT BEHAVIORS and are almost always UNPREDICTABLE: The system can have new qualities or behaviors emerge that are not directly traceable to the system's components, but rather to how those components interact over space and time. These emergent behaviors are almost always impossible to predict.

Complex Systems have MEMORY: As complex systems continually impact each other and change over time, the prior states of the system continue to influence present states.

Relationships in complex systems build DIVERSITY through LOCALIZED INTERACTIONS: Within a complex system are islands of locally contained interactions. These localized interactions can result in the emergence of different behaviors or dynamics occurring in different parts of the network thereby creating greater diversity.

Complex systems are GOAL SEEKING and have the capacity to LEARN: Through the process of feedback within a system, certain configurations of complex systems are intrinsically more stable than others and therefore will be preferentially retained and/or multiplied during the system's evolution. This learned preference for stable over

unstable states means that unstable states will sooner or later be abandoned. Over time this learning allows a unity within the system that is capable of adapting itself to change.

Simon Levin in *Fragile Domain* (1999) describes the behavior of complex systems as nonlinear local interactions among the diverse components of the system. Through these interactions the components become organized within nested systems across multiple levels of scale that determine and are reinforced by the flow (i.e., movement of energy, matter, individuals, and/or information) and interactions among the parts. These interactions create capacity of the system to absorb disturbance without shifting to another new regime of stable states – in other words its resilience (Walker & Salt, 2006).

Resilience, Transformation and Regeneration within Complex Systems:

Resilience is a property of a complex system that creates its capacity to absorb change. Resilience is defined as the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Holling, 1973). As we consider the current changes in our ecological and social systems, we see complex systems behaving in a manner consistent with an effort to remain resilient to change. For many of these systems this means undergoing significant re-organization and downsizing. One of the most prominent recent examples is the largest deleveraging of the global economy since the end of the Second World War.

Resilience is initially established and maintained in a system as its self-organizing capacity spontaneously emerges global structure out of the numerous local interactions. “Spontaneous” in this case means that no internal or external agent is in control of the process. The spontaneous process is truly collective and distributed across all components of the system. This makes the resulting structure intrinsically robust and resistant to damage and perturbations (Heylighen, 2008b).

Resilience in social-ecological complex systems has three defining characteristics (Walker et al, 2002):

- The amount of change the system can undergo and still retain the same controls on function and structure.
- The degree to which the system is capable of self-organization.
- The ability to build and increase the capacity for learning and adaptation.

A system’s resilience changes as these above characteristics increase or decrease. As a system loses its resilient capacity, it becomes vulnerable to the changes that it, in prior states, was able to absorb (Kasperson & Kasperson, 2001). In a vulnerable system, even a slight change may have dramatic results. Resiliency in a system, however, can be interpreted as a desirable or undesirable state. Eutrophication in a fresh water system is a resilient system as much as is a diverse native prairie.

In a recent study Leuteritz and Ekbia (2008) found social parameters—such as a shared community value, intentional knowledge exchange and protection of the resource—are the

dominant drivers of change in the social-ecological systems. They conclude “it is not how rich a society is and how many resources it allocates to conservation initiatives that guarantee ecosystem resilience. It is how the society organizes human activity and intervention in the environment that determines its future trajectory: Not all roads lead to resilience. (p.12)”

The resilient capacity of complex systems provides for reorganization, transformation and renewal or regeneration of the system (Gunderson & Holling, 2002, Berkes et al. 2003). Maturana and Varela (1987) have described regeneration as a network of system processes of the transformation and destruction of its own components that by their very nature produce the components that, in turn, through their interactions and transformations continuously regenerate the network of processes that produce them.

Complexity and Education:

Using a complex systems lens we see that learning is not just a cognitive endeavor but an existing natural property of all complex systems. This learning results from changes in the adaptive behavior of a system in response to feedback that ultimately affects the systems response to change in the future. A plant will grow around obstacles in order to reach the sun. The plant’s response to current conditions changes the way it will respond in the future. It has therefore learned an adaptive behavior that allows it to be more resilient to changes in its environment in the future, such as a new obstacle or low light. Resiliency of a system is linked to its goal seeking behaviors and ability to build and increase the capacity for learning and adaptation.

If learning is a design innovation of complex systems, why then are many of our human systems degrading rather than regenerating? Why are so many systems essential to our well being lacking the resiliency to absorb change? We now turn to explore how our understanding of complexity can help shape what education innovation is and what it is for as we ask what type of education innovation is necessary to foster learning for a sustainable resilient, regenerative future for all.

Transforming the Crossroads: The Goal of Education as a Transformative Learning System

David Orr (1994) often asks if education is the solution, what is the problem? He believes to effectively answer this question we must place ourselves in the web of life as citizens of a biotic community. He together with Stephen Sterling share a vision of education that extends beyond formal school as we know it to that of a continuous re-creation or co-evolution where both education and society are engaged in a relationship of mutual transformation (Sterling, 2001).

I have, until this point in this article, been exploring the properties of complex systems as a lens for viewing the world – a lens that affords us the opportunity to understand our world as a self-organizing complex system that spontaneously emerges new behaviors in response to a changing environment. We see complex systems are more than the sum of their parts. They are resilient, transformative and regenerative. The choice of a lens metaphor and the use of terms such as “see,” “view,” and “interpret” throughout this discussion have been very purposeful. While terms such as “blind,” “obscured,” and “eclipsed,” have not been used, these too are relevant

within this metaphor. It is important to recognize that viewing the world through a complexity lens does not change it. Much like telephoto lens or a macro lens in your camera does not change the physical thing you are taking a picture of. It changes your focus. It changes your perspective. The key is the relationship of your perspective to your set of choices –for it is these choices that have the potential to change the world.

Using a complex systems lens, let us revisit Orr and Sterling’s vision of education: a continuous re-creation or co-evolution where both education and society are engaged in a relationship of mutual transformation. If we are careful to interpret “vision” not as imagining something in the future but as the act of seeing, the meaning of Orr and Sterling’s statement changes dramatically. Orr and Sterling’s vision is not a future state of education any more than placing ourselves in the web of life as citizens of a biotic community is something to be done. We ARE citizens in a biotic community and education IS a continuous re-creation where both education and society are engaged in a relationship of mutual transformation. The vision Orr and Sterling offer is a new lens not a new state of the world to be achieved.

Why is this distinction important? All too often as we discuss how to address environmental and sustainability issues and how to transform educational systems we use a future tense to describe the properties of the systems we aim to change. We find ourselves saying things like “add feedback loops” when discussing organizational planning. An organization is a complex system, and as such it has feedback loops by its very nature. It just may be that those feedback loops are operating more in reinforcing “pass the buck” than ownership of the problem. Forgetting that a complex system does exist in arenas we wish to effect change is a pit we all fall into from time to time. Most of us have little practice using a complex systems thinking lens for any extended amount of time. The more that we can learn when we or others have fallen into this pit, the better we are able to understand the problem.

It was in this same pit that Donella Meadows (1997) found herself and her colleagues while sitting in a meeting about the new global trade regime, NAFTA and GATT and the World Trade Organization. “The more I listened, the more I began to simmer inside...Suddenly, without quite knowing what was happening, I got up, marched to the flip chart, tossed over a clean page, and wrote: ‘Places to Intervene in a System’ (p.2).”

Meadows captured the following leverage points (in increasing order of effectiveness)

9. Numbers (subsidies, taxes, standards).
8. Material stocks and flows.
7. Regulating negative feedback loops.
6. Driving positive feedback loops.
5. Information flows.
4. The rules of the system (incentives, punishments, constraints).
3. The power of self-organization.

2. The goals of the system.

1. The mindset or paradigm out of which the goals, rules, and feedback structures arise.

Meadows' list is a nice primer for avoiding pitfalls in our complex systems thinking. Again as we revisit Orr and Sterling's vision of education we see our current educational system is a continuous re-creation and co-evolution where both education and society are engaged in a relationship of mutual transformation. So why aren't we producing lots of people with an ecological consciousness? The problem (and thus the leverage point or opportunity) lies in part in the goal of the system. What we are currently continually re-creating is a centralized, homogenized, standardized, technologized, and industrialized thinking (to use the words of David Orr) in which education and society together mutually transform our institutions and culture into followers of a mass marketed single paradigm of a quality of life that can only be achieved through over-consumption. Change the goal and the system behaviors will change as well. (It should be noted that if we are truly complexivists we recognize that all leverage points are equally valuable and that in a complex system any change can have an impact given the vulnerability of the system.) With this in mind we are now ready to return to our central questions of the value of education using a complexity lens: what is education innovation (process); what is education innovation for (goal); and, how is educational "productivity" defined (the outcome).

The Process--Transformative Learning:

Jack Mezirow (2000) is largely credited for the development of the theory of transformative learning. He sees a defining condition of being human as "our urgent need to understand and order the meaning of our experience, to integrate it into what we know to avoid the threat of chaos. If we are unable to understand we often turn to tradition, thoughtlessly seize mechanisms, such as projection and rationalization, to create imaginary meanings (p. 3)." We witness this human condition all too often as we watch people act in contradiction to their own well-being and the well-being of the services of nature that sustain human life. The goal of transformative learning, according to Mezirow is "to become critically aware of our tacit assumptions and expectations and those of others and assess their relevance in making interpretations (p. 4)." He defines transformative learning as "the process by which we transform our taken-for-granted frames of reference (meaning perspectives, habits of mind, mind-sets) to make them more inclusive, discriminating, open, emotionally capable of change, and reflective so that they may generate beliefs or opinions that will prove more true or justified to guide action (p. 7-8)." Mezirow describes the transformation process as occurring in 10 phases typically brought about by a disorienting dilemma that calls our fundamental beliefs and values into question. This dilemma leads to a critical reflection on our assumptions, discourse to validate the critically reflective insight, followed by action.

Mezirow's theory of transformative learning has been criticized for its over emphasis on rational thought (Taylor, 1998). Based on this criticism others have broadened the theory to include a more holistic view of the person that learns and the complexity of the learning environment. This has led to the development of a transformative learning process that is more aware of and uses all the functions we have available for knowing and being, including our cognitive,

affective, somatic, intuitive, and spiritual dimensions. Today transformative learning is considered a profound experience that requires an individual's ability to take risks, a willingness to be vulnerable and an openness to have ones' attitudes and assumptions challenged.

When transformative learning is based in complexity, however, the emphasis expands from individual change to systemic change. We see change as achieved through the intentional cultivation of increasing complexity within the learner and the learning environment. The result is more than a transformation of our individual thinking; it is a holistic shift in and emergence of our collective consciousness. This shift is better captured in the definition of transformative learning posed by Edmund O'Sullivan, former director of the Transformative Learning Center at the Ontario Institute for Studies in Education of the University of Toronto.

Transformative learning involves experiencing a deep, structural shift in the basic premises of thought, feelings, and actions. It is a shift of consciousness that dramatically and irreversibly alters our way of being in the world. Such a shift involves our understanding of ourselves and our self-locations; our relationships with other humans and with the natural world; our understanding of relations of power in interlocking structures of class, race and gender; our body awareness, our visions of alternative approaches to living; and our sense of possibilities for social justice and peace and personal joy. (O'Sullivan, 2003, p. 326)

O'Sullivan cultivates complexity by emphasizing relationships that place the individual within the surrounding environment and within a localized network of interdependent relationships. John Paul Lederach's (2005) work in peace building also underscores that successful transformative learning is based on increasing complexity. Lederach believes peacemaking requires a persistent relational platform for the adaptive and continued generation of solutions that makes emergence strong and possible—the development of a persistent communion learning platform for transformation. Beyond a simple linear learning space, this transformative communion platform, through its understanding and sustaining of relational spaces, encourages transdisciplinary engaged dialog that allows for the emergence of the as-yet imagined. This platform is adaptive and smart flexible in reference to the changing environment and continuously emerging issues, obstacles, and opportunities it presents.

The Goal – Ecological Consciousness:

If the process of education is framed as a transformative communal platform creating the conditions for the emergence of the as-yet imagined – what is the goal of education? I suggest, as does O' Sullivan and Taylor (2004), Capra (2002), Orr (1994), Sterling (2001) and others, that the purpose of education is to illuminate the connectedness of our world, our collective belonging within it, and relational ways of being and acting. Stated in the language of our early vision of education, I suggest the goal of education is to continually re-create and co-evolve our ecological consciousness where both education and society are engaged in a relationship of mutual transformation of the harmonious human presence on Earth. The paradigm out of which this goal emerges is the paradigm of learning as change. Within this paradigm we understand learning as a creative, reflexive and participatory process in which knowing is seen as approximate, relational and provisional (Sterling, 2001).

The Outcome -- Catalytic Change for a Sustainable Future:

If the process of education is transformative learning and its goal ecological consciousness, what is the outcome or productivity of education? Traditional education employs a transmissive process with the emphasis on the transfer of information in order to prepare citizens for an economic life (Sterling, 2001). Here quantitative indicators assess the effectiveness of this transmission of information. Productivity is measured as the efficient movement of fixed knowledge from institution to learner. Bell curve distributions of these transmission rates are acceptable and rote regurgitation of information preferred. In this learning environment assessments are conducted externally (i.e. by other than the learner) and outcomes pre-determined. Globally this productivity is largely determined by our growing gross domestic products.

In transformative learning environments knowledge is recognized as transdisciplinary, provisional, relational, negotiated and emerging. Assessments are therefore self-generated, success indicators negotiated by the collective, and outcomes broadly drawn and constantly revisited. In this setting, productivity is ecologically based with a shift to learning as change rather than learning for acquisition. The emphasis is on process over product. Productivity in a transformative learning environment, viewed from an ecological and complex systems perspective, is measured as increasing diversity, growing clusters of localized collaborative networks, and reinforced flow of energy, matter, individuals, and information. Locally this productivity is evidenced when knowledge is distributed and applied and the silos between academic disciplines and between school and community are transcended. Globally this productivity is determined by the impact of local actions that collectively increase our ability to live in harmony with nature's systems in a manner that increases the resiliency and regeneration of the services of nature upon which life depends.

An additional measure of this educational productivity lies in the ability to create what Watts and Dodds (2007) call "global cascades." When we create transformative learning platforms for the emergence of our ecological consciousness, we evolve the conditions for "global cascades" or the wide spread propagation of influence through networks. Watts and Dodds studied the dynamics of social contagion by conducting thousands of computer simulations of populations, manipulating a number of variables relating to people's ability to influence others and their tendency to be influenced. Their work showed that the principal requirement of global cascades is the presence not of a few influential individuals but, rather, of a critical mass of adopters who changed after being exposed to a single adopting neighbor. The size and frequency of the cascade depends on the availability and connectedness of adopters, not on the characteristics of the initiators.

We regularly see this type of global cascade connected with Oprah Winfrey, an American television talk show host. Oprah has been cited as the most influential women by Time, Life, and USA Today magazines. Her impact, sometimes referred to as the Oprah Winfrey effect, may not be as much about Oprah's ability to influence, as it is her strong connection to millions of willing adopters. Much like the size of a forest fire has little to do with the spark that started it and lots to do with the state of the forest [i.e. the amount of good kindling] (Watts and Dodds, 2007). If the network permits global cascades because it has the right concentration and configuration of adopters, virtually anyone can start a cascade. If the network doesn't permit

cascades, nobody can. We as educators, through the creation of learning processes and the configuration of learning communities, have the kindling within our reach to foster a catalytic change – a global cascade — for a sustainability education and a sustainable future. But we must refocus our attention on creating even more kindling rather than lighting matches.

A Transformative Learning System

A complex transformative learning system emerges when we vision educational innovation as a transformative learning platform for ecological consciousness that catalyzes systemic change for a sustainable future. Within this system, traditional approaches to curriculum and instruction are themselves transformed. Little research has been conducted on this type transformation pedagogy—the practice of fostering transformative learning through the cultivation of complexity. Taylor (1998) found ideal conditions for fostering transformative learning (as defined by Mezirow) included promoting critical reflection and affective learning equally; providing a safe, trusting, open and collaborative learning environment; encouraging the exploration of alternative perspectives; and emphasizing personal self-disclosure, self-dialogue and solitude. Laurent Parks Daloz's (2000) study of transformative learning that occurs as a person develops a sense of social responsibility identified four salient conditions of transformation: the presence of others, reflective discourse, a mentoring community, and opportunities for action. Taylor's later work (2009) found several other elements equally significant: a holistic orientation, awareness of context, and an authentic practice. He also identified all transformative learning elements have an interdependent relationship. These interconnected conditions of transformative learning point to a curriculum that cannot be self-contained in the classroom. The community and authentic action therefore become the context for learning.

Mathematics' educator Brent Davis (2005) has integrated developments in cognitive and complexity science to explore the role of the teacher in fostering the capacity for what he calls complex, communal cognition. He uses the metaphor of “teaching as the consciousness of the (classroom) collective.” Davis explains that this metaphor is a suggestion that the teacher is responsible for prompting differential attention, selecting among the options for action and interpretation that arise in the collective. The teacher's task is not just to select from among those possibilities that present themselves. Rather, teaching seems to be more about expanding the space of the possible and creating conditions for the emergence of the as-yet unimagined. Transformative learning and teaching are not about prompting a convergence onto pre-existent truths, but about divergence into new interpretive possibilities. The emphasis is not only on what is, but also what might be brought forth. As Lederach's (2005) work suggests designing education as communion platform requires allowing for the emergence of the “mistake” that suddenly created whole new avenues of insight and understanding.

Much of the theories that inform this transformation pedagogy are themselves still in the formative stages of development. It is therefore premature to offer a “how-to” guide to creating the conditions for a communal platform for transformation. One place, however, to start is to explore practical methodologies that increase complexity within the learning environment. This includes:

- The exploration of self as a fuzzy boundary or what Laurent Daloz (2004) calls are semi-permeable self – or “ourselves as nodes in a dance with the universe” (p. 39) that are simultaneously distinct and interconnected.
- The creation of interconnected open collaborative relationships among learners, between disciplines, between school and community and between humans and the environment that both deepen our sense of place and intentionally foster the flow of matter, energy, information and individuals.
- The establishment of feedback loops and the cultivation of diversity in all its forms – with particular emphasis on the diversity of ways of knowing and being that are often in paradox.
- The fostering of distributed cognition in which knowing is not merely something that occurs inside the learner but is distributed in a learning ecology across the context and environment as well as a cultural space.

In my own work in nonformal sustainability education, I draw on conversation and community building methodologies such as World Café (Brown & Isaacs, 2005) and Open Space Technology (Harrison, 2008) and appreciate inquiry techniques such Assets Mapping (Kretzmann & McKnight 1993) as entry points for creating a communal platform for transformation. These tools allow for the exploration of questions that matter, the self-organization of dialogue, an emphasis on possibilities and a process of knowledge generation and action. I also regularly include arts-based inquiry methodologies that use the artistic process as a primary way of understanding and examining experience. This type of inquiry involves the actual making of artistic expressions in all of the different forms of the arts. From personal clay sculpting, drum circles and collaborative wall murals to co-created theatre and movement; new insights within a diversity of knowing and experiencing are generated through a creative intelligence not assessable in traditional inquiry methods.

Equally important to transformative learning are the distinct processes of narrative inquiry and storytelling. Narratives can act as a way to give shape to experience and life; conceptualize and preserve memories; and pass on experience, tradition, and values. Through both the process of sharing narratives via storytelling and exploring narrative meaning through narrative inquiry, we are able to more creatively imagine our present, past and future. For as Stephan Pace Marshall (2000) notes, a paradigm shift occurs when we become the stories we tell. I have also found the work of Margaret Wheatley (2002), Peter Senge (1990), Parker Palmer (2004) and Peter Block (2008) to hold many interesting methodologies for opening spaces for transformation.

At first glance the above methodologies appear relatively simply to apply. But once employed they rapidly and often unexpectedly challenge existing paradigms of knowledge, engagement, empowerment, ownership, and collaboration for both the learner and the teacher. They underscore the need for new skills in paradoxical curiosity, dialectical thinking, and transcendence within a context of authentic action as well as the necessity for more aesthetic and spiritual spaces of engagement and connection.

It cannot be underscored how both threatening and regenerative these transformative spaces can be. Without the ability of a group to cultivate a sense of self-as-connected, hold paradox, accept

the emergent nature of knowledge, and accept the risk in breaking from the mundane; conversations exploring topics such as our shared vision of a sustainable future quickly degrade in complexity and fall back into linear individualistic black and white truths and defensive competitive stances. Creating safe trusting relationships that allow individuals to speak from the heart over the head allows for greater risk taking, vulnerability, altruism, growth, and ultimately transformation that is hope-based, renewing and regenerative. Collectively these skills, sensibilities and methodologies open the possibilities to catalyze a sustainable future for all. In closing, Edward Taylor offers a caution to be well heeded by those embarking on this practice for the first time.

It is clear that much remains unknown about the practice of fostering transformative learning, and so it should not be practiced naively or without forethought or planning. It often requires intentional action, personal risk, a genuine concern for the learners' betterment, and the ability to draw on a variety of methods and techniques that help create a classroom environment that supports personal growth and, for others, social change (Taylor, 2006). Those who venture into this arena will have to trust their teaching instincts, since there are few clear signposts or guidelines, and develop an appreciation for and awareness of their own assumptions and beliefs about the purpose of fostering transformative learning and the impact on practice. (Taylor, 2009, p. 14)

This heed is stated more simply by Socrates who exclaimed we teach first who we are and second what we know. We begin creating a transformative learning system when we commit to intentionally discovering the self that teaches sustainability education.

Connecting the Cross-Roads: Tools for Addressing the Crisis of Education

Many frame the current state of our environment as a tragedy of the commons (Hardin, 1968). Levin (1999) notes that environmental groups urge us to "think globally and act locally," but he believes that until people also think locally, their motivation to act responsibly is weak. Whether they are thinking globally or locally, how and what they think are critical to making informed choices to act. When thinking and acting are ill-informed and inharmonious with the collective system, we have global environmental and sustainability crisis. The roots of this crisis are in our institutions of education and the diminishing return of our current educational investments.

Throughout this article I have explored several important tools for addressing this crisis. Many overlap and integrate with one another but together they provide a framework for a transformation pedagogy and an innovative approach to sustainability education. This framework requires creating a communal platform for transformation that includes the following key elements:

1. Cultivate a Sense of Place: Jared Diamond's understanding of societal collapses began with his deep exploration and connection to place. From this connection he was able to see patterns, recognize interdependent agents and understand the importance of our collective understanding and resulting actions. Cultivating a sense of place requires we seek to understand patterns,

practice interdependent living, and as Laurent Daloz (2004) eloquently states nourish our semi-permeable self. Without this deep sense of place, the remaining tools in this list are ineffective.

2. *Foster Complex Systems Thinking*: Peter Senge stated in *The Fifth Discipline* (1990) that the unhealthiness of our world today is in direct proportion to our inability to see it as a whole. A complex systems lens affords us the opportunity to understand our world as a self-organizing complex system that spontaneously emerges new behaviors in response to a changing environment. We see complex systems are more than the sum of their parts. They are resilient, transformative and regenerative. Learning is an inherent property within complex systems. A complex systems lens reframes the goals, processes and productivity of all our institutions. Foster complexity in order to cultivate a transformative learning platform by exploring relationships based on participation, feedback, emergence and self-organization.

3. *Increase Resilience and Vulnerable as Necessary*: Resilience is a systems capacity to absorb change and reorganize while undergoing change so as to still retain its identity (Walker and Salt, 2006). Many of our natural systems now have little resilience while our educational institutions have too much. But changing the resilience and vulnerability of our educational system without cultivating a sense of place and complexity can lead to too much of a good thing and not enough of another. Only increase resilience and vulnerability as necessary. Establish learning environments that foster reliable information flow on critical local and global issues, monitor and feedback knowledge into the system, reduce risk by broadening the scale at which education occurs (i.e. inside and outside the formal classroom), encourage transdisciplinary study and finally diversify, diversify, diversify.

4. *Plan for the Not-Yet Planned, Expect Surprise*: The permanence of change requires the permanence of creative adaptation. As John Paul Lederach suggests (2005) designing education as communion platform allows for the emergence of the mistake that suddenly created whole new avenues of insight and understanding. Plan for the not-yet planned by accepting the limits of knowledge and predictability, practice-dialectical paradoxical thought, create flexible response systems, act with precaution, be adaptive and smart-flexible and finally expect and delight in surprise – for it is a possible sign of emergence.

5. *Elevate Contemplation, Creativity and Communion*: Margaret Wheatley in “Turning to One Another: Simple Conversations to Restore Hope in the Future” (2002) believes that as the world speeds up, we lose the very things that make us human: questioning, curiosity, dreaming, creativity, and reflecting – all tenets of learning. Individually and collectively reclaim the time to think, feel, express and connect. Meaningfully consider the taken for granted frames of reference, understand the collective learner and diverge into new interpretive possibilities. Make a commitment to reclaim time for outward expressions of ourselves as ecological beings.

6. *Mentor, Support, Challenge, Act and Inspire*: Laurent Parks Daloz’s (2000) study of transformative learning indicates the four salient conditions of transformation are the presence of others, reflective discourse, a mentoring community, and opportunities for action. Create a safe mentoring community organized around recognition, support, challenge, action and inspiration.

7. *Think Globally, Think Locally, Act Locally, Act Locally Again*: The components or agents of a complex system initially interact only locally, i.e. with their immediate neighbors. The actions of remote agents are initially independent of each other. At first there is no correlation between the

activity in one region and the activity in another. However, because all components are directly or indirectly connected, changes propagate so that far-away regions eventually are influenced by what happens here and now. Think and learn locally to create globally thinking and learning.

8. Built Trust and Acceptance: Trust each other, trust and accept paradoxes, trust ambiguity, accept risks and be vulnerable in your thoughts and resilient in your collectiveness.

9. Make Kindling through the Celebration of Life: Societies can often best be understood by what they collectively celebrate. Create celebrations that emphasizes meaningful connection over consumption, questions over answers, and cooperation over competition. Celebrate the transitory nature of knowledge. Celebrate all ways of knowing and experiencing. Celebrate the natural services upon which all life depends. Through these celebrations, make the kindling for positive global cascades - in other words foster the catalytic ability of humans to create positive systemic change towards a sustainable future. Then light a match.

Today we are challenged to create a different future—one in which all can thrive and flourish. If we are to be successful, every individual must be a creator, innovator and steward of this future. We can no longer function as silos focused on optimizing our own piece of the puzzle. We must engage in new ways of thinking and being. We must build a shared understanding and a larger vision. We must write a new cultural narrative that brings forth a new world through shared stories. The wellspring of this new narrative ultimately lies in our capacity as individuals, as educators and communities to transform our imagination so we may freely imagine a future rooted in the real world yet capable of giving birth to that which does not yet exist.

Yet all too often we believe in our shared vision and narratives we use to communicate them (such as the vision shared in this article) but not in the inherently messy process by which we as a community acquire them. Community is a chaotic, emergent, and creative force that needs constant tending (Palmer, 2004). A communion platform for transformation requires that we remain close to the actual messiness and serendipity of ideas, processes, and change—so that from such a place we can speculate about the nature of our work, the lessons learned, and paths of our future (Lederach, 2005). Shy not from ambiguity and chaos, rather see it as a sign post marking the story of our sustainable future that connects the crossroads of our past successes and failures with our future innovations and ultimate regeneration.

A Post Note

Before we leave this discussion we should stop for a moment to consider transformative learning itself as a paradigm. Recall Donella Meadows' nine places to intervene in a system? Her top two were: 1) change the goals, and 2) change the paradigms out of which those goals emerge. Changing the goal of education to that of ecological consciousness and the paradigm to learning as change are effective places to intervene in the education. But before Donella Meadows completed her list of places to intervene in a system she offered one final addition: the power to transcend paradigms. She adds:

Sorry, but to be truthful and complete, I have to add this kicker...The highest leverage of all is to keep oneself unattached in the arena of paradigms, to realize that NO paradigm is

"true," that even the one that sweetly shapes one's comfortable worldview is a tremendously limited understanding of an immense and amazing universe...It is to "get" at a gut level the paradigm that there are paradigms, and to see that that itself is a paradigm, and to regard that whole realization as devastatingly funny...I don't think there are cheap tickets to system change. You have to work at it, whether that means rigorously analyzing a system or rigorously casting off paradigms. In the end, it seems that leverage has less to do with pushing levers than it does with disciplined thinking combined with strategically, profoundly, madly letting go. (Meadows, 1997, 84)

In this article I offer the lens of complex systems and transformative learning as a way to meet the challenge of catalyzing a sustainable future for all. This lens can help define a new role for us as sustainability educators, members of local communities and designers of our educational systems. It is offered only as an opportunity to change your focus – to vision sustainability education as a complex system that at its core is driven by a set of human choices cultivated by how, why and what we learn. I believe this lens is the basis for creating a truly transformative learning environment that holds the power to bring forth a collective ecological consciousness and to foster catalytic change for a sustainable future. But I offer this lens with the caution that you use it only long enough to know when to cast it off for others old, current and emerging that bring us in stronger communion with the goals of our multidimensional universe yet to be realized.

One cannot help but be in awe when [one] contemplates the mysteries of eternity, of life, of the marvelous structure of reality. It is enough if one tries merely to comprehend a little of this mystery every day. Never lose a holy curiosity.

Albert Einstein

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Regional transition Sustainability Higher Education Institution Organizational- and field-level drivers. 1 Introduction. Various political agendas, programmes and supra-national initiatives have emphasized the role of Higher Education Institutions (HEIs) in spurring sustainability and sustainable development throughout the last decades. In 1987 the Brundtland Report (WCED 1987) introduced sustainability as a concept which strives for a balanced social, ecological and economic development on different spatial scales. The present paper aims at shedding light on the role HEIs play in the regional transformation towards sustainability using the example of Linz (Austria) and the five HEIs located therein. The two research questions of interest are: 1. Education for Sustainability promotes 7 : Understanding Values clarification People as the key to change Systemic change Integration and innovation Alternative futures Reflection, negotiation and participation by going beyond awareness raising to address the underlying issues causing the unsustainable practices. by creating a sense of personal relevance in, and connection to, change for sustainability. by promoting capacity-building opportunities that harness the ability of. EfS considers that integration, transformation and innovation are needed to change organisational and individual behaviour. by using positive methods such as futures thinking to create alternatives to the current situation that lead to action plans for change. by