

Education for an Interdependent World: Developing Systems Citizens

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The work described here was only possible because of the many pioneers of the systems thinking movement in public education and the founders of the more recent SoL Education Partnership – Burlington, Vermont; Murphy School District in Pheonix, Arizona; the Hewlett-Woodmere District in Long Island, New York; the E3 Initiative and the Washington Sustainability Education Association; Sustainable St. Louis; Jaimie Cloud of the Cloud Institute for Sustainability Education; and Lees Stuntz of the Creative Learning Exchange, dedicated to fostering networks of collaboration among systems thinking educators. A special thanks also to Linda Booth Sweeney, who has served as coordinator of the Partnership in its formation and now supports capacity building and research in several of the sites. See the Creative Learning Exchange www.clexchange.org, The Cloud Institute for Sustainability Education

Education for Today's World, Not Yesterday's

I believe that the Industrial-Age education system that has spread around the world in the past 150 years will change dramatically in the coming decades.

This will not happen because such a change is easy. Indeed, as most educators know only too well, few institutions are more resistant to innovation and change than primary and secondary education. It will happen because fundamental change is necessary if human society is to survive and thrive in the world in which we now live. The Industrial Age is ending, and the changes coming will not be possible

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without recreating the two central institutions, business and education, which have been the primary propagators of the Industrial Age worldview and skillset.¹

Economic globalization has brought extraordinary material benefits and unimaginable dangers. For the first time in human history, billions of people share a material standard of living previously unimaginable, just as more share reasonable expectations of long life, democratic processes, and formal education than at any previous time. Just so, human beings are destroying other species and ecosystems at unprecedented rates and altering their ecological environment locally and globally as never before. The average American causes a ton of material waste to be generated *per day*, including the gaseous waste by-products of industrial life like greenhouse gas emissions.

According to Jason Clay of the World Wildlife Fund, to support today's global economy takes 1 1/4 Earths. Soon it will be more. But we have only one Earth, and the inevitable adjustment to living within the scope of her generosity grows more severe every year we continue down the "take-make-waste" industrial path.

The challenges ahead will be social and cultural as well as economic and ecological – indeed they are inseparable. According to the World Bank, the poorest quartile of the world's people saw their income share of global income fall from 2.5 to 1.4% from 1975 to 2000. Globalization has caused a collision of cultures as well as economic systems, with many around the world fighting to preserve traditional cultural identity against the spread of western style consumerism, while massive joblessness spreads as rural economies decline and tens of millions are forced to migrate to cities. In this sense, global terrorism, fueled by millions of disaffected youth with little hope for a positive future, is as inevitable a by-product of the spread of modern industrial development as is global climate change.

While most individuals and organizations are still largely in denial regarding the profound changes required to meet these challenges, more and more business-, civil-society, and governmental leaders (mostly in local government in the US) not only see the changes needed but are busy bringing them into reality (Senge et al., 2008). Fortunately, this revolution also includes a growing number of educators and communities, some of whose examples are mentioned in the following section.

These innovators are guided by imagining a different path into the future, one that leads toward *regenerative* economic system in place of the *extractive* system that has dominated the Industrial Age. They are guided by simple but profound questions. Why could we not emulate nature in creating "circular economies" with little or no waste? Why could we not interact across cultural differences with the

¹Many have argued that the industrial age ended decades ago, as the world of smokestacks and mass production was replaced by that of bits and bytes. But this confuses shifts in dominant technologies with shifts in the underlying values and processes that defined the industrial age. More steel is produced in the world today than ever before. So, too, are more automobiles produced and more coal burned. Indeed, shifts in dominant technologies are a defining feature of the industrial age, what Lewis Mumford and others called the "Age of the Machine." See "The Myth of the Machine, Vol. 1: Technics and Human Development," New York: Harcourt Brace, Jovanovich 1967.

aim of learning rather than domination, fostering a new renaissance as has happened before when established cultures were forced to face radical new ideas? Why could globalization not represent mindful stewardship of the Earth's treasures rather than mindless consumerism, awakening us to our sacred identity as *homo sapiens*, the "wise species"?

The key, to paraphrase Shakespeare, lies not in our stars but in ourselves. Below the multiple symptoms of social and ecological imbalances sits a growing gap in awareness between the nature of our reality and the nature of our thinking, symbolized in the following figure:

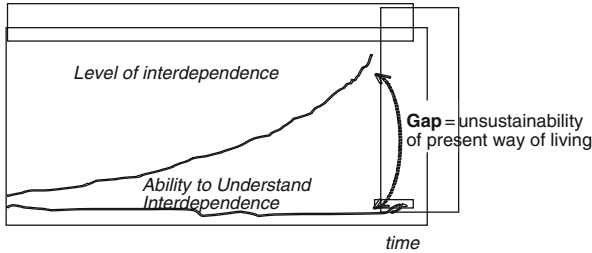


Fig. 2

Global industrial expansion has woven a web of interdependence, the likes of which has never before existed. The average pound of food travels 2,000 miles prior to its purchase by an American consumer. Many of our everyday goods travel much further.

Conversely, the by-products of our ways of living likewise travel around the world. For example, the greenhouse gasses emitted by Americans' cars and SUVs, along with our video games, flat panel TVs, and Web surfing (whose electricity is powered mostly by burning coal), 20% of worldwide emissions, contribute to shrinking glaciers, reduced spring runoffs, and hundreds of millions of chronically dehydrated people in northern India. Weather instability, flooding, and rising sea levels affect a great many more.² Soon, the same statement will be valid in reverse: as China's and India's surging economies eclipse that of the United States in greenhouse emissions (China's already has). Never before in human history have people's daily choices on opposite sides of the globe been so entangled.

But while this web of interdependence has been growing, our capacity to understand interdependence has not; indeed you could argue that it has steadily deteriorated over centuries. As humans have moved from tribal to agrarian societies and more recently to the modern industrial society, our sense of connection to the larger living world has progressively become more and more tenuous. For example, recent studies have shown that many American children believe that their food

²In 2007, Oxfam estimated that the costs to the world's poor of adapting to global climate change (including costs due to loss of crops, spread of tropical diseases, and migration) exceeded \$50 billion. (see www.oxfam.org) This figure is expected to rise sharply in the coming years.

comes from the grocery store, and most have no concept of seasonality in food, since all foods are available at all times.

Because this decline in capacity to understand interdependence has happened over many generations, it has largely gone unnoticed. Native peoples do not need to read books to understand their dependence on and responsibilities to “Mother Earth”; it constitutes the very roots of their culture. Farmers likewise must understand the dance of sun, wind, rain, soil nutrients, and water flows or they cannot survive as farmers. We need to understand neither, and consequently do not.

As this gap grows, our way of living becomes increasingly unsustainable. Very few adults today understand the global economy, let alone where the goods they buy come from, or the social and environmental by-products of the global supply chains through which they move. Few know, for example, that the worldwide expansion of industrial agriculture, mostly to serve middle-class consumers in the north, which displaces tens of millions of rural residents per year due to falling farmer incomes, is a major source of greenhouse gases (not only CO₂ from shipping food around the world but methane from the expansion of livestock to meet growing demands for meat), and has caused the loss of over a billion hectares of topsoil in the past 50 years, more than the size of India and China combined.

While there are many facets of the malaise of global industrial society, it is hard to imagine much real change without beginning to address this gap between our growing interdependence and our ability to understand that interdependence. No technological fixes are likely to solve climate change alone. No global government is likely to suddenly appear to deal with the growing stresses of food and water. No enlightened corporate responsibility movement will miraculously change the DNA of global business so that short-term profit comes into balance with long-term contribution to people and planet.

All of these changes, and more, *will only happen as our thinking changes*. The institutions of the modern world work as they do because of how we work. How we think and interact shape their policies and practices, neither of which is likely to change on their own.

Thinking Newly, Educating for New Thinking

Time does not go backward. Our task is not to re-create yesterday’s cultures of interrelatedness but tomorrow’s. This will require deep change in all the primary institutions that shape modern society – none of which is more important than education because none has a larger long-term impact.

“To be a teacher is to be a prophet,” said Gordon Brown, former Dean of the MIT School of Engineering and a founding inspiration to the systems thinking in education movement. “We are not preparing students for the world of today, or the world that teachers have grown up in; we are preparing students for a world that we can barely imagine.” Education is the one social institution with a 50-year-plus time horizon. Business does not have this. Government does not have this. The media

does not have this. But, school, by its nature, does. That is why education is always a key to the future direction of a society.

When education is driven by incessant pressures to perform on standardized tests, get good grades, and get into the right college, in order to get a good job and make lots of money, then education reinforces the consumerism and economic orthodoxy that drive the present global business system. When it is oriented around deeper questions of human and social development, it can contribute distinctly to the larger needs of a society needing desperately to reorient its priorities. In this sense, education is a natural leader in this time of “great turning,” when the Industrial Age is dying and, as Vaclav Havel put it, “something new, still indistinct, is struggling to be born.”

While this might sound romantic or grandiose, I believe the kids in school sense the significance of the moment. More than ever before in history, today’s young people grow up with an awareness of the world. They know about climate change. They know about our addiction to fossil fuels. They know about the persisting gap between rich and poor. They are often in direct communication with friends in other countries, and they know about the struggles of the world’s cultures to live respectfully with one another. As such they are disengaged when education that will shape their future does not address the imbalances, and when it does, they thrive.

Young people know that we are “living into” a new global society. What they don’t know is whether their teachers know about it. What they don’t know is do adults care enough and have enough courage to re-create education to match *their* world. Regardless of how they express it, they know that the only citizenship that matters today is global citizenship, how the people of the world work together to, in the words of Buckminster Fuller, “create a world that works for everyone.”

The overarching aim of education must become developing “systems citizens,” a generation of young people whose capacity to understand interdependence is commensurate with the interdependence that shapes our lives. This aim will take us all into new territory. No one knows how to do it. There is no set curriculum, anymore than there is agreement on the processes of learning that will be needed.

Moreover, educators won’t be able to do this by themselves. The modern school is an expression of public priorities and sits within a complex web of societal accountabilities. In the Industrial Age, school became the domain of specialists who taught fragmented subjects in a way that was fragmented from the lives of the learners and the larger community (Senge, 2000). Re-creating education will be a job for communities committed to a future that has a future, not just for professional educators.

Our efforts to explore this new landscape through the SoL Education Partnership focus on four foundational changes³:

³SoL (the Society for Organizational Learning – www.solonline.org) is a network of individuals and organizations who work together around the world for systemic change. The SoL Education Partnership focuses primarily on communities within the US where educators, local businesspeople and government, and youth organizations are working together to create a climate for continuing innovation toward educating systems citizens.

- systems thinking,
- authentic youth engagement,
- rethinking schools as learning communities, and
- education for sustainability.

The overarching aim is not educational reform but recontextualizing the whole process of education: starting with young children learning how to be more responsible for their own school environment and gradually moving to interconnecting diverse stakeholders in tackling complex real-life community issues. In this process, students stop being passive recipients of someone else's curriculum and become active agents in developing a sense of responsibility and efficacy for an interdependent world.

Systems Thinking

The first systems thinking classes at Orange Grove Middle School started in 1988, instigated by Frank Draper, a science teacher, and encouraged by Mary Scheetz, then Orange Grove's principal. When my wife, Diane, and I first visited Frank's 8th grade science class in 1991, it was hard not to notice that something was different. First, Frank was nowhere to be seen. In fact there was no teacher in the room. A couple of students had some questions about their library research, and Frank had gone to the library with them (remember, this was much before the Internet). But, to our amazement, the classroom had not descended into chaos. Instead, the thirty or so students were glued to their new MacIntosh computers, two to a machine, deeply engrossed in their conversations with one another.

We learned that Frank and his colleague Mark Swanson had designed their semester science curriculum around a real project, the design of a new state park to be developed on the north of Tucson. After studying the sorts of conflicts that inevitably arise in park and wilderness area management, they were working with a STELLA-based simulation model that showed the impacts of different decisions.⁴ They had an overall budget and prescribed mission based on environmental-quality, economic, and recreation and education targets they set for the park. At the time, they were working on designing the park's trail system. Once they would lay out a proposed trail, the simulation model calculated the environmental and economic consequences, prompting energetic debates over trade-offs among different options.

We had only been standing in the back of the room for a few minutes, and a couple of young boys came and grabbed us. "We need your opinion," Joe said. "Billy (the boy's partner) has a trail system that he thinks is great because it makes a lot of money (routing hikers past the best views), but it also does a lot of environmental

⁴STELLA and ITHINK are products of ISEE Systems, Hanover, New Hampshire: www.iseesystems.com

damage. Mine avoids the environmental impact areas, but he thinks it is too close to the Indian Burial Grounds and will stir up protests.”

We listened for a while as the two boys explained their different trails and showed us some of the simulated consequences. There were no black and white answers, and it was clear that they understood this. This was about design and making choices. The bell rang signaling the end of the period, and they said goodbye, agreeing as they left to come back after school to see if they could agree on a proposal to share with the rest of the class at the end of the week. (Eventually, the students’ proposals and analyses were presented to the actual park planning commission at the end of the term.)

Barry Richmond has identified eight constituent thinking skills that comprise a broad definition of systems thinking⁵:

- *Dynamic Thinking* – seeing patterns of change over time rather than focusing only on isolated events.
- *System as Cause Thinking* – recognizing that problems and their solutions are endogenous: They arise within a system, not from outside.
- *10 K Meters Thinking* – being able to step back and see the big picture.
- *Operational Thinking* – understanding how the structure of a system causes its behavior, and that the same basic structures apply to all systems. Understanding stocks and flows.
- *Closed-Loop Thinking* – recognizing feedback: Any action has consequences that can influence that action again.
- *Nonlinear Thinking* – knowing that feedback loops interact to produce changing responses over time.
- *Quantitative Thinking* – being able to consider and include all variables, even those that cannot be measured in standard units.
- *Scientific Thinking* – recognizing that all models are working hypotheses to be rigorously built, tested, and refined.

In that particular project at the Orange Grove, the students were learning to see change – the consequences of how the park’s trail system was laid out – as differing patterns of behavior over time (Richmond’s “dynamic thinking”). This was also illustrated earlier, when I argued that many of today’s most pressing problems could be understood as arising from a particular pattern of behavior over time: the growing gap over time between interdependence and our understanding of interdependence.

The students were also practicing stepping back to see how one change can have many different effects as the change plays out in a larger system, and how that system has its own distinctive characteristics and generates particular forces (10 K meter thinking and system as cause thinking).

⁵See “Tracing Connections: Voices of Systems Thinkers,” forthcoming (2010).

And, they were learning how to formulate a hypothesis: what sorts of consequences they expected from different changes and testing their expectation against a formal model of the system (scientific thinking).

The students also learned a variety of conceptual tools for mapping systems and for expressing and communicating with others about their understanding of interdependence. Again, these were applied to real-life situations the children could identify with, including ones drawn from their own lives. Today, tools like “behavior-over-time graphs,” “connection circles,” “causal loop diagrams,” and “system archetypes” are introduced as early as third and fourth grade, and young children are invited to look at daily experiences like how trust builds or deteriorates in a friendship, or what happens in breaking a bad habit (Quaden, Ticotsky, & Lyneis, 2009). As students get older, they can naturally extend these tools to more complex subjects, including developing their own simulation models.⁶ This develops not only deep content knowledge but thinking skills to see how common system dynamics can underlay very different situations.⁷

“Our approach was to invite kids to consider a worldview of complex interdependent systems. Instead of abstract learning, we use simulations to begin to confront and to penetrate this world of interdependence as it is embodied in particular real-life situations, and how these systems relate to other systems,” says Frank Draper.

This work is challenging and requires dedicated teachers like Draper and Swanson willing to wrestle with some timeless questions, as well as newer ones brought to light by the systems worldview – like, What if the education process throughout primary and secondary school continually build on children’s innate curiosity and capacity to construct their own understanding rather than digesting a teacher’s understanding? Learning through doing is ultimately essential for retention and meaningfulness, but how can this learning be extended to more complex subjects where the consequences of our actions are no longer immediate? What really are our innate capacities to understand complexity, and how far could this intelligence develop if it were really nurtured?

Authentic Youth Engagement

What was equally evident from the outset at Orange Grove was the engagement of the students. What made the state park exercise so engaging for them?

⁶See, for example, Diana Fisher, “Modeling Dynamic Systems: Lessons for a First Course,” available at www.iseesystems.com. In this book, Fisher shares examples of remarkable student work that includes college and post-graduate level work done by high school students versed in systems modeling tools.

⁷The idea of “generic structures” is a cornerstone of systems education and ranges from simple dynamic structures like delays that arise in virtually all social systems (and confound decision-makers expecting immediate results from their actions) to more involved structures like “aging chains” which arise in diverse settings from demographics to product life cycles.

First, they were wrestling with real-world problems rather than artificial school-room exercises. They could identify not only with the challenges of developing a new state park but also with the benefits of designing the park well.

Second, they were thinking for themselves. They knew there was no single right answer to the challenges they were facing. Ultimately, they had to understand better what would happen if different decisions were made, and they had to frame trade-offs. There was no single formula presented by the instructor to gain the right answer. Rather, they had to sort out their own thinking about a real issue and explore different proposals – ultimately coming to their own conclusions.

Third, the teachers operated as mentors, not instructors. The teacher's role was not to give a prescribed method or guide the students to a predetermined right answer. Indeed, the teachers did not know the best outcome and were colearners with the students. But the teachers' roles were no less crucial: They had to help the students make sense of the outcomes of different experiments. Having been involved in building the computer simulation gave them important knowledge for this task but no simple answers: A complex dynamic simulation model will often respond to changes in ways that its developers do not anticipate, as different feedback interactions play out over time.

So, the learning project was mutual for teacher and student. Though they had built the simulation model, it *was* a model and thus, by definition, incomplete. Indeed, one of the teachers' roles was to help the students appreciate the assumptions upon which the model was based, and to invite the students to critique those assumptions and consider the implications of alternative assumptions, a critical aspect of scientific reasoning.⁸

Lastly, working with partners drew the students into a joint inquiry. This not only enabled them to get to know one another but forced them to continually confront alternative views and assumptions. This drew students into a natural process of seeing how each of us reasons from past experiences and assumptions to draw conclusions that guide our actions, and to becoming more open to testing their reasoning.

Of course, human beings follow such processes of inferential reasoning all the time, but it is often easier to see how this works in another situation, since our own reasoning is often "transparent" or invisible to us. Educators understand the importance of reflection – learning how to examine our own assumptions and reasoning – but it remains an elusive educational goal, all but completely ignored by traditional schooling. Didactic instruction bypasses it entirely. Teachers' efforts to try to get students to reflect is easily undermined by teachers' authority and formal power, which intimidates students programmed to seek correct answers. As Scheetz said, reflection requires safety, which benefits from an environment of mutual inquiry. In this sense, students helping one another reflect is a powerful approach that goes well beyond teacher-centered strategies.

⁸For examples of students developing their own simulation models see D. Fisher, "Modeling Dynamic Systems: Lessons for a First Course", Second Edition, available from iseessystems.com

For example, consider the followed (slightly stylized) interaction between Joe and Billy working on their park trail system.

Billy: “Your trails are a bad idea because they are too close to the Indian burial grounds. You shouldn’t do that.”

Joe: “Who says? There are no rules that say we can’t do that. They do a lot less environmental damage than yours.”

Billy: “Yeh, mine *are* a problem. But what is worse?”

Joe: “I didn’t really think about the burial grounds. Maybe there is a way to avoid the burial grounds and also do less environmental damage also?”

Billy: “Yeh. Maybe, but I wonder how much less money we’ll make; the park has to generate enough money to stay open. Let’s try some other routes.”

In this simple interaction, the two boys are practicing Richmond’s “operational thinking,” understanding how specific features of the structure of a system cause its behavior (such as how trail location affects visitor hiking patterns, environmental effects, and park revenues) and how changes in that structure can change system behavior.

As important, the boys are engaging in a critical collaborative learning process: probing one another’s ways of thinking through the design problem they face and, in the process, making their own thinking more explicit. Plus, they are helping one another – neither is right or wrong, both are learning. Joe hadn’t really thought about the Indian burial grounds as a constraint; this was outside the assumptions upon which he was operating. Likewise, Billy had not paid a lot of attention to the environmental damage of his trails because he was focused on maximizing hiker traffic and park revenues. Both become more aware of taken-for-granted assumptions through the other’s inquiry. Both conclude that there may still be better overall designs if they expand their assumption sets. In short, the boys are mastering the basics of reflective learning based on collaborative inquiry, becoming more aware of their own taken-for-granted assumptions through thinking together.

Of course, such interactions only work if there is mutual respect. It is easy to imagine two young boys simply arguing about who is right, and never challenging their own reasoning.

This is why educators like Scheetz understand that realizing the benefit of systems thinking tools depends on the overall school environment. “An environment where learning is likely to occur,” said Principal Mary Scheetz, “is one that is safe and secure, and where taking risks is OK.”

What if we saw learning how to see systems as inseparable from learning how to see one another? What if we saw the foundation for systems citizenship as a seamless blend of cognitive and interpersonal skills in learning about complexity, anchored in learners’ ongoing discovery about what it means to grow as a human being in relationship with one another? What if teachers, as well as other adults working with kids, saw themselves as mutual learners along with the students?

Rethinking Schools as Learning Communities

Early on in Orange Grove's movement toward adopting systems thinking and "learner-centered learning," the staff realized that their success depended on the overall learning culture at the school, starting with how they interacted with one another.

For example, teachers often espouse an ideal of collaboration but lack practical experience at truly creating a collaborative work environment. Of all professions, teaching is among the most individualistic. Whereas most people in business or architecture or law have an acute sense that their accomplishments are the result of a team effort (even though some individuals may have more visibility to a customer or a client), teachers typically operate in a highly fragmented world of *their* courses and *their* students. Working as teams does not come easily to teachers who have spent most of their lives in an educational system that emphasizes individual performance and competition, reinforced by a professional work environment that forces them to practice their craft alone much of the time.

It takes time and commitment to go beyond platitudes about collaboration. "Of all the changes I tried to lead as principal, helping teachers learn how to team was probably the most difficult," says Scheetz. She personally led several-day retreats, where teachers began to reflect and listen to one another more deeply and to build different capacities for dealing with the inevitable conflicts that arise between different teachers' lesson plans or strategies with particular kids. "There is so much more potential for collaborative solutions than normally gets realized given the professional isolation common to most schools," says Scheetz.

Scheetz and assistant principal Tracy Benson (who later succeeded Scheetz) made sure collaboration became part of teachers' daily lives by redesigning the school schedule so that all teachers had 45–60 min free to clinic with one another, each day. "Collaboration only starts to make a difference when teachers have time to practice coordinating in real time," says Benson. "They need to know what Billy's teacher found out in his first period class or how a new systems idea that is suppose to integrate across civics and science is actually playing out for the kids. This is what actually helps them feel like a team."

Gradually, Orange Grove's teachers began to build a larger vision of the type of school culture they wanted to create. "We have to lead by example," said Martha Jones (check name), a history teacher. "If we show respect to the kids and to one another, the kids see that." Over time, the Orange Grove teachers found that their hard work in developing themselves as a learning community started to reshape how they interacted. "Any topic we talk about is a process of building a community," said Tom Keys, a math teacher. "Dealing with all our differences is the key to building our shared vision."

As the teachers developed as a team, so did their understanding of how specifically to move toward the overall school environment they envisioned. In the end, this came down to one idea: respect. "Teachers are always trying to improve discipline. We took a radical approach: we abandoned all the rules," said Jones. "We eventually

came up with one rule: show respect. We don't put one another down. We have to continually learn to listen to one another, not just superficially but actually."

Building learning communities does not stop at the four walls of the school. School cultures based on genuine respect and student engagement affect how people think and act and naturally start to bridge to encompass the larger community. Ironically, building this larger community is often more common in poorer settings, where resources are scarce and people must work together.

The Murphy School District in Pheonix, one of the founders of the SoL Education Partnership, is one of the poorest in America. Yet, the members of the community have succeeded in creating networks of mutual support that have led to delivery of food and clothing to those in need, a decrease in youth violence, domestic abuse and substance abuse, and an increase in student achievement over the past 3 years. A recent study by SoL researcher Dennis Sandow found that the "Students and their families, as well as the neighborhoods within Murphy School District, all benefit from a large, collaborative social system whose members include but are not limited to not-for-profit, government, faith-based and business organizations, teachers, councilors, parents, and Murphy School District graduates. There is a single (although unstated) purpose to this social system: to generate health and well being for Murphy School District students, families and neighbors" (Sandow, 2006).

Traditionally, the professional isolation of teachers is mirrored by the way schools see themselves as isolated institutional entities sitting apart from the larger communities in which they are embedded. This tragically often becomes a self-fulfilling prophesy: Isolated schools contribute little to their communities and in turn fail to tap the potential engagement and support from those communities. As this happens, the reciprocal benefits from acknowledging and cultivating the interdependence between school and community are lost.

"Maybe it is the harsh circumstances of Murphy, but it has always been obvious that if school here is to succeed it must become a hub for community building," says superintendent Paul Mohr, a founding member of the SoL Education Partnership. "When that happens, the benefits for students as well as adults can go well beyond what educators can do on their own." Over the past 5 years, student achievement at Murphy has increased significantly because of, according to Sandow, the larger "social system supporting the Murphy School District student's academic achievements."

What if "school" was defined not by institutional geography but by the geography of students' lives? What if the "teachers" were not just the professional educators but all the adults (and the older youth) with whom a student interacts? What if we assumed that sustaining innovation in education will only occur to the extent we develop collaborative networks linking local business, local social services and government organizations, and families who share a common vision of supporting kids in their development? What if we realized that whatever shortage we perceive in teachers is but an artifact of the fragmentation of school from the larger community – that, in fact, there are vast numbers of potential teachers waiting to be asked to help?

What would this mean for how education works in general and for nurturing systems citizens in particular – through reconnecting school and the larger communities

to create a rich laboratory for students learning how to build healthy interdependence here and now?

Education for Sustainability: Making Systems Citizenship Real

The Monte del Sol charter school in Santa Fe, New Mexico, came up with a simple way to start reconnecting school to the larger community, the school's innovative "community learning project" requirement. Here's how it works.

Every tenth grader at Monte del Sol can identify something she or he wants to learn that someone in the community can teach her or him. The resulting project then constitutes one of his or her five required courses for the year. I have met students at Monte del Sol who have learned carpentry, consulting, and community organizing. As important as what they learn is how they learn it. Freed from the classroom, they re-create the oldest form of education, apprenticeship. Not only does this lead toward learning that has real meaning to them, it connects many adults with students and gives them a sense of being meaningful contributors in the school, paving the way for both to work together for building healthier and more sustainable communities.

Jaimie Cloud of the Cloud Institute, a national leader in education for sustainability for over a decade, identifies seven primary "habits of mind" to be cultivated in education for sustainability (Federico, Cloud, Byrne, & Wheeler, 2009):

- *Understanding of Systems as the Context for Decision Making.* The extent to which one sees both the whole system and its parts as well as the extent to which an individual can place one's self within the system
- *Intergenerational Responsibility.* The extent to which one takes responsibility for the effect(s) of her/his actions on future generations
- *Mindful of and Skillful with Implications and Consequences.* The extent to which one consciously makes choices and plans actions to achieve positive systemic impact
- *Protecting and Enhancing the Commons.* The extent to which one works to reconcile the conflicts between individual rights and the responsibilities of citizenship to tend to the commons
- *Awareness of Driving Forces and their Impacts.* The extent to which one recognizes and can act strategically and responsibly in the context of the driving forces that influence our lives
- *Assumption of Strategic Responsibility.* The extent to which one assumes responsibility for one's self and others by designing, planning, and acting with whole systems in mind
- *Paradigm Shifting.* The extent to which one recognizes mental models and paradigms as guiding constructs that change over time with new knowledge and applied insight

Cloud sees education for sustainability as integrating ideas and approaches from many different content areas, like “ecological literacy” (science principles and natural laws that help understand the interconnectedness of humans and all of the Earth’s systems), system dynamics and systems thinking, “multiple perspectives” (truly valuing and learning from the life experiences and cultures of others), “sense of place” (connecting to and valuing the places in which we live), “sustainable economics” (study of the connections between economic, social, and natural systems), citizenship, participation and leadership (the rights, responsibilities, and actions associated with participatory democracy toward sustainable communities), and creativity and visioning (the ability to envision and invent a rich, hopeful future).

Obviously, education for sustainability is more than just new curriculum. It is about how the content and process of education can be interwoven with *real-life contexts* to create opportunities for young people to lead in building sustainable communities and societies. In short, real education for sustainability is only possible in concert with systems thinking, authentic youth engagement, and rethinking schools as learning communities to catalyze a radical shift. No longer is education something that adults do to kids. Education becomes a joint learning process for communities learning to become more sustainable.

For example, before I knew of the Monte del Sol charter school in Santa Fe, local businesspeople had given me an impressive local magazine, “Sustainable Santa Fe.” In addition to high-quality articles focused on community sustainability challenges and innovative responses by local organizations, I noticed the editorial byline: In order to advertise in the magazine, companies had to first meet certain criteria of waste management and energy efficiency. So, not only did the magazine feature sustainability-oriented stories, it fostered healthy competition among local businesses for positive brand image. It was only later that I discovered that the magazine was in fact a product of a group of Monte del SoL students teaming up with local community mentors in desktop publishing. Indeed, it was the students who had the idea of the advertising criteria.

In such projects, students become catalysts for engaging their communities, as they have at Brewster, New York High School, where science teacher Scott Beall created a novel way to teach 10th and 11th grade science, “Do Right Enterprises.” Beall told his largely conservative school board he was connecting meaningful science education with developing entrepreneurial skills. In fact, he had a bigger aim. For example, Brady teaches students how to conduct energy audits and then engages local businesspeople as clients. Not only do the students learn how to apply science to practical analysis, even local businesses start to reduce their energy (and carbon) footprint. Along the way, the students discover the difference they can make to their community.

“We thought we were doing the students a favor by letting them come in and gather some data from our restaurant,” said one local businessperson. “We had no idea how much waste they would find, and how much money we could save.”

The difference for student learning, even as defined more traditionally, is dramatic. “There is no doubt that the kids in the “Do Right” course learn as much science content as counterparts in more traditional science classes,” says Beall. In

fact, their New York Regents' science exam results tend to be as high or higher than counterparts in more traditional classrooms. "There are many ways you can design meaningful service learning sustainability projects with particular curricular content in mind," says Beall. "The big payoff is student motivation and a completely different understanding of what it means to *do science* rather than do schoolroom exercises."

When education for sustainability is connected to authentic youth engagement, learning naturally becomes intertwined with youth leadership development. "I think we tend to greatly underestimate young people's capacities as leaders," says Les Omotani, superintendent of the Hewlett-Woodmere district and another SoL Education Partnership founder. Starting several years ago, Omotani invited high school students to learn the disciplines of learning organizations and how to become systems thinkers and to serve as facilitators for community dialogues that the school hosts. "The young people learned that they could help adults have meaningful conversations about how to make the community, including the schools, more healthy," says Omotani. "The adults at Hewlett-Woodmere have learned to listen to and support the students' voice and come to see the students as important leaders, a view that many of the young people have accepted as well." The whole process is anchored in the yearlong Youth Leadership Forum, which invites students to focus on their own development as servant-leaders and systems thinkers, including change projects they shape themselves. Projects in recent years have included replacing disposable cups with reusable cups in the school and a "bag the bag" project that produced and promotes the use of reusable bags, rather than plastic bags, in the community.

"It's hard for me to imagine achieving the changes ahead without empowering the voice of young people to take responsibility for their own future," says Omotani, "rather than graduating disempowered and disengaged high school students angry at the irresponsibility they see all around them. We believe that a twenty-first century high school education must not only prepare our graduates for higher education and how to make a living but perhaps more importantly to prepare them to live (create) a sustainable and high quality of life!"

Stories like these also implicitly raise basic questions about how education for sustainability might address fundamental developmental needs for teenagers long neglected by traditional secondary education.

For most of human history, by the age of thirteen to fifteen, children had gone through some sort of rite of passage that signaled their joining the adult community. It was well understood that it was important that they discover how they could contribute to that larger community. Confining students in their mid-teens to classroom instruction and traditional academic exercises not only fails to tap their creativity, it also ignores fundamental developmental needs to deepen their sense of personal purpose and to learn how they can make a difference. It is impossible to know how much of the anomie and developmental anxiety young people encounter later in life, in their twenties and thirties, has its roots in neglecting these developmental requirements in their teens.

Noted anthropologist Edward Hall, who had spent his life studying child-rearing in diverse cultures, felt that confining young adults to schoolroom learning

“(ignores) the primate base we are built upon. . . Until a generation ago, males were warriors at the age of 18. . . with all that energy, those glands going like mad, they shouldn’t be in school. They’re tearing things apart! We should educate them before and after” (Hall, 1980, 1988).

What if we learned once more how to create meaningful rites of passage for entering young adulthood, and this were integrated into the educational process? How much of the frustration for students and teachers alike would be alleviated if we stopped seeing traditional classroom education as the anchor in secondary education and school became more a sort of base camp for young people exploring how to deepen their own sense of responsibility and efficacy – and the content of the curriculum were organized around this core developmental need? What if we stop seeing them as school children and, as Omotani says, saw them as important leaders in building more sustainable communities? How much would this contribute to the shifts desperately needed in awareness, understanding, and values needed to build a more sustainable world?

Learning that Lasts

These schools afford a rare opportunity to glimpse the longer-term consequences of education for systems citizenship. Orange Grove was one of the first public schools in the US to adopt systems thinking, authentic youth engagement (what they called “learner-centered learning”), and building schools as learning communities, starting in the late 1980s. (Education for sustainability was not a term used explicitly then, but many of the school’s projects focused on these priorities.) Now, thanks to a recently released video documentary, we can see some of the longer-term effects.

Filmmaker James Morrison and former Orange Grove teacher Joan Yates recently brought together seven former Orange Grove students, including several who had been part of an earlier PBS satellite video program when they were students, 14 years earlier. The former students’ reflections indicate powerful life lessons tracing to their experiences as middle schoolers.

“My overwhelming positive recollection was one of being involved in what I was doing; there not being a set outcome; of learning on the go, of presenting at the end of the day a result that was *totally mine*, that didn’t conform to a typical school-sheet form,” says James, now an attorney. “I remember that as a very powerful thing. I really felt like I was seeing real world results.”

The systems perspective was very real for the kids when they were students, as evident in these quotes from the original video: “I like the flexibility.” “You use it almost automatically: just like that, you analyze a problem as a system.” “We are so much more motivated than kids in other schools.” “You learn so much more than you would if it was just paperwork.”

And, it clearly had stuck with them 14 years later. Dave (a high school teacher today) talked of seeing a classroom as a system: “From the minute they walk in from home, managing thirty kids in a room five times a day is all about the systems.”

Nat (now a medical resident) commented: “(I notice) how often people use the word “system” and why the levers people try fail. In a recent documentary on New Orleans (after Hurricane Katrina), I was struck by how often people said that we need to use a systems approach so that this does not happen again: the failure in the levies happened because multiple parts of the system that should have been considered were not, whether it was wetlands or the height of the levies or whatever – people just didn’t consider how all of this would interact.”

“It (systems thinking) really made us think out of the box, rather than just follow the easiest answer or the first answer that comes to you,” according to Athena, a dentist today.

Interestingly, one of the lasting effects of their systems thinking work as teenagers was a sense of humility that had carried into their careers as adults: “Systems thinking teaches you to not take the straight line path between point A and point B,” said James. “That’s such an important lesson, not just for children, but for everyone. The ultimate lesson of systems thinking is that it’s always more complicated than you think. As a parent, I cannot think of anything more important I could teach my children, because it goes to addressing so much in our society – not just what we do as professionals, but for who we are as people and how we interact with our community and how we interact with the world at large. I think systems thinking is an imperative for how we educate our children, both now and in the future.”

In the original video, Scheetz talked about the importance of creating “simulations where students learn how to make decisions to improve a system.” Interestingly, when the adult students go together, several reflected on what they had learned from the systems simulations they had done years earlier.

“In an ideal world, patient care would work like a good simulation,” said Nat. “You come with your set of knowledge but you have access to people you consult with. A cohesive approach is especially important with complicated patient illnesses.”

Others talked about a city planning simulation they had done as students and the lessons it had left, like understanding trade-offs in making decisions. “I had located the school next to a shopping mall,” said Kelly, now a nurse, “because I thought getting kids to shop would be good for the economy. But, it also promoted truancy. I hadn’t thought about that.”

The adult former students also talked about the importance of collaboration and learning from one another as a defining feature of their Orange Grove experience. In the original video, many of the students’ comments had focused on the importance of working together: “Working together we get to know one another. . . You learn more trust.” Another commented: “You had a partner and you could converse a lot. . . there was so much freedom but you also had a goal.”

Fourteen years later, Andy (now a trade negotiator at the Department of Commerce) commented, “(In order to get things done) you are completely dependent on your ability to understand other people’s thinking. . . (for example in negotiations with the Chinese) to understand their positions, what sorts of pressures people feel domestically from their constituents. It’s really hard to shift from a

‘push’ type of argument, trying to convince someone, to ‘pulling’ them towards you. Making that sort of mental transition was really beneficial in my work.” Interestingly, in the original video, 13-year old Andy had commented, “You really have to start to learn to listen to other people. . . because you may actually be wrong.” Seeing this, Andy commented, “I had not realized how much of this insight came from the 8th grade.”

Appreciating collaboration is rooted in understanding the limits of each person’s mental models, starting with your own. “You have your perspective and you have to seek others’ views,” said Nat. “You learn pretty quickly that the docs are pretty knowledgeable but so too are the nurses and the support staff, and many have been in the trenches a lot longer than you have. You need to pay attention to one another and actively seek their advice.”

Clearly, for these young adults, systems thinking and learning collaboratively had shaped their worldviews in profound ways. In Andy’s words: “The real question is, are you, when you are the person in a position of power, willing to let it go? Are you willing to ask, ‘I don’t know – what do you think?’” For Athena, “Yes, we learned to look for more complexity, but also to look to our peers.” For Nat, “I think we learned how to actively seek out knowledge together.” For Dave, “When you look at other middle schools and you talk with other people, this really was a different place.”

Conclusions

“Education is the most powerful weapon, which you can use to change the world,” said Nelson Mandela. As concerns grow around the world around “sustainability” and the overall path of global industrial development, businesses, NGOs, and governments are stepping forward to confront increasingly critical issues around food, water, climate change, destruction of ecosystems, waste and toxicity, and growing gaps between rich and poor. But, if you believe that the shifts ahead will be cultural, not just technical, the potential role of education looms large.

Hoping to direct attention to this role, the United Nations declared the decade from 2005 to 2014 the decade of “Education for Sustainable Development.”⁹ This is encouraging, but the response in schools to date far less than what is needed. Today, what passes for sustainability education mostly is reworked environmental science curricula, even though the UNESCO emphasizes that it is about more than ecology but affects an “integrated approach to education, learning and life.” Still, few school systems have reprioritized their goals. Most teachers remain focused on “teaching to the test,” seeking to improve student achievement in traditional subjects. Few business and public-sector leaders have stepped forward to “connect the dots” between essential long-term societal changes and a fundamental rethinking

⁹See portal.unesco.org/education/en/ev.php-URL_ID=27234&URL_DO=DO_TOPIC&URL_SECTION=201.html

of the aims of primary and secondary education. Lofty sentiments do not make a revolution – yet that is exactly what we need.

In my view, two things are missing.

First, we must build a meaningful consensus as to the scope and substance of education for the twenty-first century and how it differs from education in the past. Perhaps, the vision of systems citizenship can help focus this budding consensus. Whether we are ready or not, young people will inherit a world in which they are first and foremost global citizens, not national citizens. Unlike any time in human history, young people today grow up with an awareness of the world, and with increasing connections to other young people around the world. It is irresponsible that they should leave secondary school without understanding how the global economy works, or understanding the basic interconnections between healthy economies, healthy societies, and healthy ecosystems. It is tragic that they should leave without genuine curiosity about and engagement with other cultures, for which, often, they need but to travel across their city.

I believe that *systems thinking provides the missing intellectual and cognitive underpinning for education for global citizenship*. This is starting to be understood among business and civil society leaders. “If I reflect on what many organizations have been going through, the whole awareness of sustainability has been growing because systems thinking, in different forms, is enabling us to see much more interdependencies than we have seen in the past,” says Andre van Heemstra of Unilever Management Board. He adds: “It is those interdependencies which make you conclude that it is more than stupid, it is reckless to think of commercial sustainability in isolation of either social or environmental sustainability” (Senge et al., 2008, p. 217).

Barry Richmond’s eight “systems thinking skills” offer a starting point in translating the need for systems thinking into the curricula and pedagogy needed to achieve it. By building upon the foundations of critical thinking and scientific reasoning, Richmond offers a bridge to mainstream ideas that are widely accepted. He extends these to incorporate thinking and learning skills almost completely missing in education today: namely, “the endogenous viewpoint” and learning how to identify feedback dynamics and understand the nonlinear ways complex systems can respond to simple changes. Long regarded as the stuff of graduate education, 20 years of evidence now exists to show that, done well, these skills can be nurtured in primary education and developed to remarkably advanced levels in secondary education, not just for an elite but for the majority of students.

Today many educators embrace goals like students “should know how to think systemically.” But little will change without rigorous programs of study, teacher training, and curriculum development. When combined with developments in education for sustainability and reflection and youth engagement, I believe there is much to build upon to create such programs.

Second, we must face the fact that it is unlikely that basic innovation in education will be accomplished by educators working alone. The failures of endless “educational reform” movements to produce large-scale lasting changes offer mute

testimony to forces that work to conserve the status quo in public education. The problem is not that educators do not have new ideas. The problem is that we, as a society, demand that education continue to operate in the main as it did when we were children. This immense cognitive anchor becomes the source of the political movements that inevitably rise up to squelch meaningful experimentation, the sine quo non of innovation. This inherent conservatism will continue to thwart innovation until communities of leaders from *education, business, civil society, and local government start working together* to support ongoing basic innovation, not remediation in public education.

We do not need to have all the answers worked out in advance in order to build these coalitions. We do need to have the capacity as communities to prioritize and persist in supporting new thinking and new practice. We don't just need teachers who are "prophets," as Gordon Brown called for. We need diverse leaders from all sectors willing to travel together into a future we can only begin to imagine. Education for life after the Industrial Age requires realizing that humans will actually be living together differently in the coming decades or they will not be living much at all – and that young people often have deeper intuitions than do adults regarding the changes coming.

Through the SoL Education Partnership, we are working together to embody and explore in several communities around the country what these new partnerships can look like. In particular, we are working to connect innovators from business and civil society with their counterparts in education. Many businesspeople live in a world where either you innovate or die. They understand how to manage the risks that come with experimentation, how to focus on testing new ideas in local ways before they are extended prematurely to broad application, how to finance and assess innovation. But to date, the businesspeople drawn into working on education have mostly been reacting to perceived shortcomings in schools, rather than focusing on the real needs of creating sustained innovation.

A natural alignment exists between innovators in the private sector and innovators in education, but this alignment has not yet developed sufficiently to have large-scale impact. Leaders in the private sector know that they need people who can think for themselves; solve complex problems in creative teams; work effectively with people from different cultures; and maintain a global, longer term perspective while dealing with immediate problems at hand. Yet, relatively few of our schools are focusing on these requirements in educating students, and most school systems and state departments of education are still sadly out of touch with these very real needs.

Lastly, pursuing both this new consensus and building these new cross-sector partnerships will, I believe, bring us as a society to confront a core unasked question: *In a world of growing interdependence, what is the purpose of education?*

There is a timeless aspect of the purpose of education, enabling young people to grow as healthy and contributing human beings. Most people drawn to teaching as a life work are drawn because of this calling, to be part of how children and young people grow and develop as human beings. This is the love of learning for its own sake.

But there is also a timely and contextual aspect of education, which starts with recognizing the specific challenges society faces and how education must be part of solving these problems. This is the aspect of education that Nelson Mandela reminds us of, and it is to this aspect that education for systems citizenship points.

No one works consciously to destroy ecosystems, or to widen the gap between rich and poor, or to use water and topsoil more rapidly than they are replenished, or to increase concentrations of greenhouse gases to the point of destabilizing global climate. All these changes occur as unintended by-products of business-as-usual. The problem is that, whether as businesspeople, consumers, or voters, we tend to operate with blinders. Individuals make decisions, like the products we buy, with virtually no awareness of the consequences of their choices for others. Companies maximize profits with little attention to the larger social costs, like the costs of climate change. Governments pursue national interests with little regard to the fact that all nations' interests are now increasingly bound together.

We have the sustainability issues that we have because, as individuals, organizations, and societies, we are unable to see the larger systems we have created that shape modern society, and we are unable to work together across institutional and national boundaries to create alternative systems.

Our core task is simple – to create a truly *regenerative economy and society*, one that operates based on the defining principle of all interdependent living systems: Life creates conditions for life. It is time to recognize that young people have the largest stake in the unsustainable future we are now shaping, and they are more than ready to share in creating an alternative. Are we?

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