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On Hope and Agency in Sustainability: Lessons from Arizona State University

Christopher Boone
Arizona State University
Christopher.G.Boone@asu.edu

Abstract: Since Michael Crow, President of Arizona State University, founded the School of Sustainability in 2006, sustainability has become a central focus at the University. ASU offers both undergraduate and graduate degrees in sustainability, from Bachelor's degree to Ph.D. level. The author, the Dean of the School of Sustainability at ASU, discusses how the University's programs foster hope and agency among students and prepare them to address the pressing challenges of living and working sustainably. The author focuses primarily on curricular strategies and also addresses some extra-curricular strategies employed at ASU. He also discusses post-graduate employment patterns of alumni who have built upon their educational experience at ASU to become agents advancing sustainability in their work.

Keywords: hope, agency, social transformation, Arizona State University's School of Sustainability, curriculum, sustainability competencies, extra-curricular engagement, student outcomes, sustainability careers

Christopher Boone is Dean of the School of Sustainability, Arizona State University. His research contributes to ongoing debates in sustainable urbanization, environmental justice, vulnerability, and global environmental change. He is a scientist for the urban Long Term Ecological Research projects based in Baltimore and Phoenix and sits on the scientific steering committee for the Urbanization and Global Environmental Change project. He is an active contributor to Future Earth, an international initiative that aims to integrate the global environmental change community with a focus on sustainable outcomes. Boone serves on the Executive Committee of the Council of Environmental Deans and Directors. He is the author of two books on urban sustainability, City and Environment and Urbanization and Sustainability, and is the associate editor for the journals Frontiers in Ecology (Urban Ecology) and Current Research on Cities. He also serves on the editorial board of the International Journal of Sustainable Development and Environment Justice. For Cambridge University Press, he is co-editor of the book series, New Directions in Sustainability and Society. At ASU, he has taught classes on sustainable urbanization, urban and environmental health, principles and methods of sustainability, environmental justice, interdisciplinary methods for socio-ecological research, and sustainable design (Innovation Space).

On Hope and Agency in Sustainability: Lessons from Arizona State University

A typical pathway for students entering as first time freshmen in the School of Sustainability at Arizona State University is taking the Advanced Placement test in Environmental Sciences in high school. When I ask students what draws them to sustainability rather than biology or ecology, they respond that sustainability is not about doom and gloom—rather, it offers hope and invites everyone to do something about creating a desired future for people and the planet. As young people anticipating decades of their own future lives in an era of significant social and environmental challenges, there is a strong vested interest in not accepting the status quo. They recognize the burdens they inherited from present and past generations but are motivated to make change for the better. In short, they are drawn to the principles of hope and agency embedded in sustainability.

Arizona State University's School of Sustainability (SOS) was founded in 2006 as the first comprehensive degree-granting program in the United States. From the outset, it offered the Bachelor of Arts, Bachelor of Science, Master of Arts, Master of Science, and the Ph.D. degrees in Sustainability. It is a college equivalent school that reports directly to the university provost. The 16th president of ASU, Michael M. Crow, has been a stalwart supporter of sustainability as a principle and a discipline since he arrived in 2002. Sustainability education has expanded to all colleges in the form of minors, concentrations, and concurrent degrees. As of June 2015, there were 1700 students enrolled in sustainability programs. Since the launching of the sustainability minor in 2010, nearly 5000 students have taken the Introduction to Sustainability course. The point of this description is to illustrate that sustainability is not a marginal exercise at ASU—it is a pervasive and defining presence at the university (Boone 2015). Students in sustainability programs are engaged in a university culture that is highly supportive of sustainability principles. Nevertheless, lessons from ASU are transferable to other colleges and universities where sustainability programs are in place or being planned. As of 2012, there were more than 140 degree programs in sustainability (Vincent 2012). As programs mushroom across the country, colleges and universities are educating greater numbers of students, building the critical mass necessary to tackle sustainability challenges.

What follows is an examination of key ideas and strategies employed in SOS that build on the notions of hope and agency. The primary focus is on curricular structures with some consideration of extra-curricular strategies. I also touch briefly on alumni and the careers that advance their aspirations after graduation.

Intervention

A key difference between most environmental science programs and sustainability is a focus on interventions. Similar to public health, sustainability teaches students that integrated, systems-level interventions are appropriate for achieving desired outcomes. An intervention can be an experimental treatment with appropriate controls or can be a method for charting an alternative pathway. An intervention can be technical, such as a micro-grid to facilitate renewable energy use (Bhandari et al. 2015), ecological, for example a wetland restoration to treat wastewater (Tao et al. 2014), or social, such as the creation of food hubs to improve farmer livelihood and improve community access to nutritious food (Blay-Palmer et al. 2013).

Implicit in the notion of interventions is that the status quo is inadequate for achieving long-term, sustainable outcomes. Students are taught that path dependency, inertia created by past decisions, can be very strong force and difficult to alter. Path dependency can be seen in physical form such as concrete sewers, or institutions such as food safety regulations, that when created had the best intentions of solving a critical issue but may now limit sustainability innovations. Food safety regulations, for instance, can limit the ability of small-scale farmers to supply consumers with fresh food because of the high costs of inspection that are uniformly applied regardless of the size of farm (Parker et al. 2012).

Sustainability requires interventions, but students are taught to recognize that interventions can create new path dependencies that future generations may have difficulty undoing. This is a conundrum, although students learn in their coursework that interventions can be designed with flexibility and opportunities for self-correction built in. A shift from gray infrastructure to green infrastructure in stormwater systems brings the concrete conduits to the surface where retention ponds, bioswales, and other designs use ecosystem services to retain, clean, and deliver stormwater to aquifers or safely to streams and other water bodies. Because the systems are not buried, they can be monitored closely for performance and adjusted as necessary. Green infrastructure brings other co-benefits, such as green space for recreation, wildlife habitat, carbon sequestration, and local cooling, and in many cases provide those benefits at less cost than conventional systems (Elmqvist et al. 2015). The design of the green infrastructure can be modified to deliver certain ecosystem services depending on changing priorities over time (Gersonius et al. 2013). However, in order for such systems to function as intended, new forms of flexible, integrated governance are required. If green infrastructure is left solely in the hands of public works without consulting other stakeholders (e.g. parks and recreation departments, water and energy departments, community groups), it is unlikely to succeed. Governing using a sustainability systems framework is another form of intervention that provides opportunity for flexibility and self correction (Ferguson et al. 2013).

Despite potential dilemmas of interventions—the potential for further lock-in and unintended consequences—students in the program come to recognize that change experiments are necessary given current trajectories such as the rapid rise of atmospheric carbon dioxide. An important lesson here is that changes that reduce carbon emissions now will benefit generations for at least a century given persistence rates of carbon dioxide in the atmosphere. That is a very powerful, motivating message.

Solutions learning

Since its founding, SOS has embraced problem and project based learning, which is effective for addressing complex problems from a systems perspective using a student-centered approach and with teachers as facilitators (Wiek et al. 2014). Problem based learning is also shown to be effective at improving learning and meeting course outcomes when the problems are authentic and linked to the real world (Walker and Leary 2009). SOS faculty and staff identify four levels of real world linkages. The first is *bringing the world in*, and can include case studies or guest speakers that address a class on a real world sustainability issue. The second is *visiting the world,* which might include participant observation, attending a public meeting, or shadowing experts. The third level is *simulating the world*, which could include interactive games and role playing.

The final level is *engaging with the world*, such as writing an opinion piece for a newspaper, an internship, or a workshop with external clients. In general, the transition from levels one to four requires more student responsibility and self-directed learning, a willingness to work outside the classroom setting, and an expectation of collaborative learning and mutual understanding with partners within and beyond the university (Brundiers et al. 2010).

A variation on problem based learning is an approach that emphasizes solutions not as the absence of the problem but of a desired condition, an idea that reinforces the normative aspects of sustainability. From an initial focus on problem and project based learning, in 2014 SOS adopted a solutions learning approach. This does not neglect the need to understand the nature of problems or the role of projects as a learning mechanism, but it begins with a different philosophical starting point. Paralleling the difference between most environmental science and sustainability programs, solutions learning emphasizes the notions of hope and agency, particularly the latter. By focusing on the notion that solutions, rather than the absence of problems, is possible, it encourages students to recognize their own abilities to create interventions for positive, innovative change.

Students in SOS have the chance to tackle and design effective solutions in their coursework, in a mandatory internship, and in solutions workshops. One example of a solutions workshop is *Innovation Space*, a multi-college collaborative course that divides students into teams with a representative from sustainability, graphic arts, industrial design, engineering, and business. Each team is provided studio space and over two semesters develops solutions to a socially pressing issue. This past year, three teams developed solutions for improved mobility and well-being of disabled people confined to wheelchairs. The teams consulted with individuals in wheelchairs to gain perspective on the day-to-day challenges. Each team developed new items to improve the comfort and utility of wheelchairs while focusing on the beauty and functionality of design, the business case and marketing materials, and a life cycle analysis of the materials. Their final designs were pitched to working designers at a public forum in downtown Phoenix. During the course, students learn about the patent process, intellectual property rights, creating business plans, entrepreneurship strategies, systems mapping, collaborative team building, and a host of other skills (Selin and Boradkar 2010). It is an excellent example of the fourth level of engaging the world and bringing to the table innovative, tangible solutions.

Internships are a mandatory component of our undergraduate program because they provide students with a very rich, solutions-oriented experience. Early in the school's history, we invested in an internship coordinator to ensure that students find meaningful internship opportunities (engaging with the world) and this experience is coupled with a course that assists students in getting the most out of the internship. At the end of the semester, the school hosts a poster session open to the university, community, and employers where students can present and discuss the results of their internship. Students are encouraged to think about how their internship added value and made a difference to their host organizations. The experience gives students a chance to confront the challenges and realties of working outside the university but also to enumerate the concrete ways they can contribute to positive change.

Key competencies

The undergraduate curriculum is designed around five key sustainability competencies that SOS faculty developed, now replicated in programs around the world (Wiek et al. 2011). They are *systems thinking*, *anticipatory* or *future thinking*, *normative thinking*, *strategic thinking*, and *interpersonal* or *collaborative thinking*. Systems thinking is fundamental to sustainability because students are required to think simultaneously about multiple domains (social, ecological, technical, economic, cultural) at multiple spatial and time scales, and to understand the dynamics of systems, such as inertia and path dependencies, feedback loops, tipping points, cascading effects, and so on. Anticipatory or future thinking requires students not necessarily to predict the future but to develop and analyze visions and models of plausible futures. Normative thinking includes the ability to think about desirable outcomes but also to negotiate different value systems towards common goals. Strategic thinking focuses on approaches and methods such as interventions, stakeholder engagement, or scenario development for getting to desired states. Interpersonal or collaborative thinking is based on the idea that multiple constituents are required to advance sustainability strategies, and students require the team building, negotiation, cross-cultural and other skills to make that happen. These five competencies are woven and reinforced throughout the curriculum, and we have developed specific courses that take a deep dive into each of the sustainability competencies.

Program level learning outcomes

Graduates of the program should be able to demonstrate how their knowledge and skills relate to the key sustainability competencies. To assess progress, the SOS faculty developed program level learning outcomes (PLLOs) during a retreat and later mapped learning outcomes from individual classes to the PLLOs. The primary mandate of the PLLOs is for graduates of SOS programs to *meaningfully combine and apply systems thinking, values thinking, futures thinking, strategic thinking, and interpersonal/collaborative competence for solving sustainability problems and enhancing the sustainability of complex social-ecological-technical systems*. For each sustainability competency, the faculty created five to seven higher level learning outcomes. Under the interpersonal/collaboration competency, one of the program level learning outcomes is to "demonstrate leadership skills both as a team leader and team member by overcoming carriers to collaboration, motivating team members, resolving conflicts, ensuring the wellbeing of oneself and one's team." Under systems thinking, one of the learning outcomes is to "critically reflect on one's own ways of systems thinking in the context of different ways of acquiring knowledge as well as knowing, including different scientific methods and disciplines as well as traditional knowledge systems." I point to these two examples to underscore the importance for students to know that they have individual agency, but they must also respect the agency of others who may hold very different sets of priorities and world views. By developing the skills from each of the competencies, students will be able to find ways to align goals to achieve sustainability outcomes not possible by individual effort alone.

Building hope and agency beyond the classroom

In addition to the internships and workshops that provide real-world learning opportunities, a growing number of alumni are finding positions in sustainability where they can practice what they learned and make a difference to a broad constituency. Some organizations see a "sustainability deficit" looming, with insufficient numbers of students graduating with the

necessary knowledge and skills to tackle pressing issues such as climate change, endemic poverty, and energy insecurity (IEMA 2014). Employment data for our alumni confirm the need for students educated in sustainability. For our undergraduate alumni, 96% are employed and 3% are pursuing graduate degrees. Of those employed, 76% are in careers related to sustainability, a jump from 46% the year prior. This figure is very encouraging since nationwide, the match rate of college major to career is 27% (Abel and Deitz 2013). The private sector employs 71 percent of our alumni, followed by government (9%), education (8%), non-profits (7%), and the remainder as entrepreneurs.

One characteristic I have observed is that our students are entrepreneurial. In 2014, SOS won an award for the college at ASU with the highest percentage of students who entered a university entrepreneurship competition, another indicator of the sense of agency promoted in sustainability education. Because SOS was the first school of its kind in the United States, the idea of innovation seems to infuse the culture. Our students developed the first Honor Society for Sustainability and is now working with other colleges and universities to create beta chapters (honorsocietyforsustainability.org). Students created an online journal, The Sustainability Review, to showcase sustainability research and practice using a variety of formats, including video essays (thesustainabilityreview.org). In 2015, students launched and received a charter for a new co-ed sustainability fraternity—Delta Alpha Upsilon—devoted to upholding sustainability principles. In the spring semester, students organized a zero waste organization committed to helping ASU achieve its goal of being a zero waste campus. Students were successful in getting the university to pilot composting bins in Wrigley Hall, home of SOS and the first facility to receive these services. These initiatives demonstrate the energy and initiative of students to make positive changes in sustainability, but also show the importance of extra-curricular activities for enhancing agency.

Transitions: Bending the curve

A critical lesson we impart to our students is that significant changes in condition for people and the planet are possible. Resilience theory is one mechanism for demonstrating how systems can shift (or not) if a disturbance or perturbation exceeds certain thresholds. Transitions to a new state can be a negative outcome, such eutrophication of water bodies, or positive, such as the end of slavery. Transitions can permit leapfrogging of tradition pathways. For instance disruption in communications technology that long relied on cables and expensive switches allowed for the widespread adoption of mobile phones in developing countries, improving knowledge of markets, providing access to banking and credit, creating educational opportunities, improving emergency response and health outcomes, among many other benefits (Beratarrechea et al. 2014; Wagner et al. 2014). In our courses, the demographic transition model is used to show how fundamental properties of human existence can change. Others used in courses are the energy transition from animate to inanimate power and the promise for renewables, the transition from agricultural to industrial and service economies, the civil rights movement, and the digital revolution. These and other examples reinforce the idea that radical change is possible.

Another key message is that transitions are driven by *people* responding to challenges and opportunities of existing social-ecological-technical systems. Conscious, deliberate design can facilitate transitions to new stable states (Markard et al. 2012). We teach our students that transitions can be accelerated by 'bending the curve' of current trajectories. A good example is

the projection of greenhouse gas emissions provided by the IPCC. Under business as usual with little to no intervention in fossil fuel emissions, GHG levels would continue on a smooth upward trajectory that could reach 1000 parts per million by the end of the century. Other scenarios, based on mitigation strategies to reduce GHG emissions, bend the curve downward with the potential of limiting GHG concentration to a safer 450-480 ppm (IPCC 2014).

Bending the curve to facilitate a sustainability transition goes back to the idea of interventions. Students learn about the political stalemates that have slowed progress on climate change mitigation, but they are also taught that progress is possible and that plans are in place for seriously mitigating climate change. One is a plan by the World Bank on how to decarbonize the global economy, reduce net carbon dioxide emissions to zero, and limit global increases in temperature to no more than 2 degrees celsius by the end of the century (Fay et al. 2015). To reach these goals, the report argues that decisive action to decarbonize must be taken immediately—waiting will only increase costs and suffering. Although action at the international level, such as the UN Framework Convention on Climate Change, is critical, students also learn that individual action to mitigate climate change can aggregate to have significant impacts. The messaging here is important since individual action on something as large as climate change could seem futile. Turning this notion on its head, individual action, such as reducing a carbon footprint, can be seen as something that has far-reaching impacts, given the global circulation of carbon dioxide, and long-lasting consequences, given the long life span (from decades to hundreds of years) of new carbon dioxide emissions in the atmosphere (Inman 2008). From their own little corner of the globe, a student's decision can impact someone or something thousands of miles away for generations. This ability for an individual to have a long-term global impact by decisions made today is a very powerful expression of agency, and if done well, for hope.

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