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Retrofitting the Ivory Tower: Engaging Global Sustainability Challenges Through Interdisciplinary Problem-Oriented Education, Research, and Partnerships in U.S. Higher Education

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Abstract

Various experts and institutions, including the United Nations, have stressed the complexity of the 21st century's global sustainability challenges. Higher education institutions should be at the center of research and education to meet these challenges. However, these institutions also find themselves in crisis, in part due to the economic recession, but also due to traditional disciplinary barriers that do not always incentivize interdisciplinary collaborations and public outreach. Challenges to interdisciplinarity are discussed, and examples of successful approaches are presented to demonstrate possibilities for prioritizing problem-oriented research and education tied to community and industry partnerships across higher education.

Keywords: general education, interdisciplinarity, sustainability, partnerships

Global Sustainability Challenges and What It Will Take to Address Them

In the last 20 years various experts and institutions have repeatedly identified the following global sustainability challenges for the 21st century: climate change, nutrition and health, biodiversity loss, poverty, pollution, resource depletion, food security and safety, access to clean water, sustainable energy development, overfishing, and ocean acidification. In *Transforming Our World: The 2030 Agenda for Sustainable Development*, the United Nations *(2015)* identified numerous key global challenges to address over the next 15 years and then adopted an intergovernmental resolution *(A/RES/70/1, September 2015)* with 17 aspirational goals (see Figure 1).

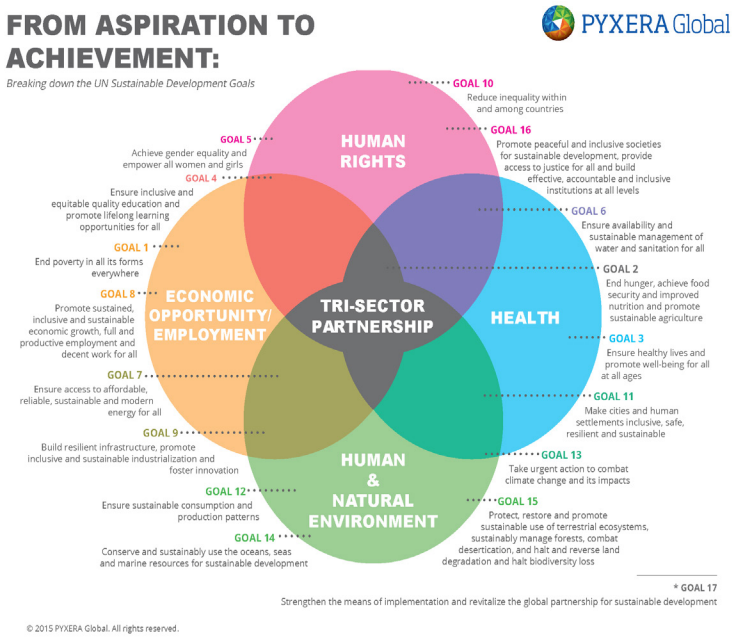

Figure 1. Seventeen UN Sustainable Development Goals (Pyxera Global, 2015).

Not surprisingly, U.S. institutions of higher education have frequently been the focus of calls for more research, education, and engagement in these areas. Disciplinary knowledge and professional training are certainly essential to meet these challenges; however, they are not sufficient. These complex problems, not coincidentally, also require the same kinds of skills and abilities that employers most often cite as highly valuable in employees: ability to think critically and reason analytically; analyze and solve complex problems; effectively communicate orally and in writing; apply knowledge and skills to real-world settings; locate, organize, and evaluate information from multiple sources; innovate and be creative; work in teams and collaborate in diverse group settings; and connect choices and actions to ethical decisions *(Hart Research Associates, 2013, p. 8)*.

U.S. universities and colleges are poised to more strategically offer better preparation in these skills and abilities while also addressing global sustainability challenges and the needs of our local communities and workforce. As Mulkey *(2012)* argues, "We can save both this planet and higher education by developing liberal arts curricula that have sustainability education as a foundation"

(p. 356). For the purposes of this article, *sustainability education* includes any aspect of education that delivers content and skill sets that are relevant to addressing the global and local sustainability challenges outlined here. In order to develop the understanding and innovations that complex global sustainability issues require, it is essential to support and develop problem-oriented research and education through interdisciplinary collaborations, community and industry partnerships, and general education curricula that provide students literacy about major global challenges and the skill sets and experiences critical to complex problem-solving, communication, and teamwork.

In this article, I review both the development of sustainability as a popular concept in the context of global challenges, and some of the challenges and thinking at the root of the crisis facing U.S. institutions of higher education, in order to explore ways in which the challenges of both present mutually beneficial opportunities for innovation. These opportunities themselves are not without implementation challenges, but several models exist from which institutions of higher education can draw, not only to adapt to the 21st century, but to do so in ways that prepare their communities to better address this century's greatest challenges.

Sustainability: A Brief Overview

For clarity and context, it helps to review the larger discourse surrounding sustainability in higher education and its connections to interdisciplinarity. Current discourse on sustainability has its origins in 1972, when several nations from around the globe met in Stockholm, Sweden for the United Nations Conference on the Human Environment to "delineate the 'rights' of the human family to a healthy and productive environment" *(United Nations General Assembly, 2010)*. This conference led to a series of subsequent meetings and the establishment of institutions and working groups within the United Nations. In 1983, the World Commission on Environment and Development (WCED) was created. *Sustainability* as a term gained popularity in 1987, when the WCED produced the report *Our Common Future (1987)*, often referred to as the Brundtland Report for Gro Harlem Brundtland, chair of the WCED. The document emphasizes the equally important, linked concerns of social equity, ecological integrity, cultural diversity, and economic stability. *Agenda 21: The UN Programme of Action from Rio (1993)*, which contains the Rio Declaration, came out of the UN's first Conference on Environment and Development (UNCED) in June 1992. Agenda 21 also emphasized that sustain-

able development is dependent on our ability to balance economic, social, and environmental concerns. According to the UN General Assembly report of the Secretary-General *(A/65/314)*, *Sustainable Development: Harmony with Nature (2010)*,

> Since UNCED, sustainable development has become part of the international lexicon. The concept has been incorporated in many UN declarations and its implementation, while complex, has been at the forefront of the world's institutions and organizations working in the economic, social, and environmental sectors.

The usefulness and accuracy of the term *sustainability* has been debated in publications across disciplines, from rhetoric to conservation biology and economics. For the purposes of this discussion, I use *sustainability* for its contextual grounding in the above-referenced UN documents; regardless of whether true sustainability is practically achievable, as a conceptual compass it can help us define and prioritize global and local challenges and guide human action, decision making, policies, and innovations toward inclusive social and economic development, peace and security for communities and nations, ecological integrity, and what Richards *(2013)* refers to as eudaimonia or "the good life." It may be co-opted, as critics rightly point out, by various interests to serve whatever ends it can be bent to serve, but the general concept provides an undeniably crucial function in global affairs and has the potential to shape U.S. higher education in the 21st century.

As "an effort to integrate disciplinary approaches in order to tackle complex problems," interdisciplinarity goes hand-in-hand with sustainability *(Bursztyn & Drummond, 2014, p. 314)*. Additionally, Bursztyn and Drummond *(2014)* assert, "Interdisciplinarity plays a major role in the debate about the sustainability of human societies, in general, and about the crisis and the future of the University" *(p. 313)*. For example, Roger Beachy *(2011)* of the National Institute of Food and Agriculture (NIFA) urges that scientists need to think like social scientists and humanists, even incorporating them in their teams, in order to innovate feasible, usable solutions, and impact society positively on local and global scales in both the short and long term. Furthermore, he recommends that colleges and universities facilitate interdisciplinary research, collaboration, and networking between disciplines and with community and industry partners, noting this is key to meeting today's global, regional, and local challenges. Bursztyn and Drummond *(2014)* explain, "The

more we advance, the more we need to find solutions for the problems linked to our advancement," and those solutions increasingly require creativity and a mosaic of expertise *(p. 313)*.

The Public Higher Education Crisis and Sustainability

It is not surprising that calls for sustainability education and continued growth in the "green" jobs sector echo both nationally and globally. Yet the sustainability movement's integration into U.S. higher education has been largely through campus operations. Some institutions, like Unity College in Maine *(n.d.b)*, have successfully incorporated sustainability across all aspects of the college and curricula, but few institutions have seen sustainability education and goals rigorously and concretely incorporated into their mission statements, advancement and planning strategies, departmental curricula, and general education learning outcomes, and few have explicitly tied sustainability education to highly valued skill sets or to the social and cultural dimensions of sustainability.

Despite the global sustainability challenges we face, in the past quarter century, how much transformation have we actually seen in terms of higher education's response? Has sustainability literacy risen among college-educated citizens? Most importantly, has higher education adapted to match learning outcomes with the global challenges we face and the skills employers seek today? Are we preparing future generations to address challenges, solve problems, and prevent further deterioration in quality of life for all? Are we encouraging and supporting faculty research that does so? Having provided an overview of sustainability, I now turn to a brief discussion of the crisis in U.S. higher education not only to show how the two are connected, but also set the context for simultaneously addressing some of the challenges in both arenas.

Addressing the challenges of the 21st century and preparing our students to live and work successfully in this century require fundamental changes in how universities and disciplines have traditionally functioned. This is an opportune time for faculty and academic leaders to address both global sustainability challenges and the crisis of the university by calling for a paradigm shift in how we think about general education, disciplines, teaching, and research, and how we prepare our students for addressing the challenges of the day while, as scholars, attempting to do the same. The answers do not lie in closing doors and narrowing focus, but in using the cornerstones of higher education to create new models.

As budget cuts dominate concerns on college campuses, sustainability initiatives and their associated resources are being cut, perceived as "a fad of the new millennium" *(Carlson, 2015, p. 23)* with limited relevance to the mission of higher education or the solutions needed to lead U.S. higher education out of crisis. The impact of the economic situation facing many institutions of higher education is widespread and far-reaching, resulting in significant cuts to campus areas and programs perceived as having a low, direct, and short-term benefit-cost ratio.

This reduction to cost savings and benefits is evidence of economism, an underlying problem at the root of both the university and sustainability crises. Leiserowitz and Fernandez *(2008)* describe economism as the "privileged place economic analysis holds in policymaking and the acquiescence of other disciplines to the rules of economic discourse"; thus, "many individual decisions, some with deep moral implications, are now determined primarily by income and prices" *(p. 63)*. The overapplication of an economic lens at the expense of other perspectives narrows everything from our priorities and values to our opportunities and ability to innovate, and we see the impacts globally as well as within U.S. higher education. This push to value economic benefit above all else risks leading us into an increasingly narrow future, jeopardizing our ability as a nation to innovate solutions to complex problems or avoid inventing new problems, as well as our ability to make healthy sense of our lives and contribute to our communities as ethical, civically engaged individuals.

Faust *(2009)*, citing Fallis, notes that universities are nevertheless caving to pressure from taxpayers, government, and their corporate and other financial supporters to align their missions, strategic plans, and assessment with a market model *(p. BR19)*. As well, most institutional and state boards overseeing educational reform are dominated by business professionals, not educators or academic experts. Sahlins *(2009)* argues,

> The university is in need of reform, if not revolution. It will not come from boards of trustees and captains of erudition whose main qualifications and functions consist of raising money, for which purpose they are prepared to treat the intellectual organization of the university as the pecuniary means of a business enterprise. *(p. 1017)*

LeMenager and Foote *(2012)* also critique the impact of economism on students, "whom the system of higher education has turned into a class of people valued as customers and virtually ignored as intellectuals in all but a handful of schools" *(p. 576)*. Indeed, I have heard colleagues outside the humanities, for example, argue that the humanities may serve a purpose at a large research institution, but at a regional comprehensive master's institution, students just need job skills and professional training. Yet clearly, employers want more than that, as the 2013 survey conducted by Hart Research Associates demonstrates. If the broad intellectual perspective that general education provides is severely reduced or removed from public institutions, becoming the purview of private liberal arts colleges, then only the elite will have access to such an education. However, if institutions adapt their general education programs to the needs of today, with a focus on the kind of interdisciplinary, problem-oriented education critical to sustainability and today's workforce, those institutions will produce a citizenry better prepared for addressing today's global and local challenges, which require more than specialized knowledge and job training. Faust *(2009)* concludes that higher education "has the responsibility to serve not just as a source of economic growth, but as society's critic and conscience" *(p. BR19)*. Bursztyn and Drummond *(2014)* envision, "The solution is not the scuttling of the University, but rather reinventing it" *(p. 323)*. But how? Where do we go from here?

How can institutions work to address systems and structures that hinder and even undermine much-needed sustainability education and research, and develop models that foster interdisciplinarity, interinstitutional collaboration, and community and industry partnerships that have the potential to revitalize higher education's position in American society while addressing complex local, national, and global problems? Sustainability education is most effectively delivered in an interdisciplinary environment that helps students grow intellectually while navigating complex problems and developing constructive thinking, teamwork, systems thinking, and other skills that have tangible applications. How can we strengthen our foundational general education curricula so that, combined with training in their majors, students leave college with sustainability literacy as well as the skills, disciplinary expertise, and multifaceted perspectives that employers seek and that solutions to global challenges require? In short, how do we retrofit the ivory tower to the 21st century?

From Crisis to Opportunity: A Retrofit of Educational Approaches in Higher Education

Higher education finds itself challenged by an increasing gap between the world of academia (the ivory tower) and the social, economic, and environmental realities of our age *(Bursztyn & Drummond, 2014, p. 319)*. Hales *(2008)* argues that we are inadequately prepared to address the major global challenges the world faces because our institutions—higher education and other systems—"are demonstrably incapable of long-range planning, dominated by peculiar and special interests, fragmented in authority and responsibility, and designed to allocate abundance, not scarcity" *(p. 23)*. Interdisciplinary research, training, and collaboration are increasingly important to addressing the complex problems we face today. Reflecting this, major funding agencies like the National Science Foundation have initiated problem-oriented grant programs emphasizing such collaboration. But as Bursztyn and Drummond *(2014)* warn, "Unless changes are made, the gap between societies' demands for solutions and the capacity of the University to provide them will continue to increase" *(p. 314)*. Thus collaborations must also build networks with community and industry partners as well as other institutions.

As Beachy *(2011)* explains, we need to think of ourselves and our students not as pupils of particular disciplines but as pupils of *problems*—problems of societal relevance that, embodying the complexity of the real world, cut across disciplinary borders and thus can only be solved in disciplinary convergence zones. Such a shift requires institutions of higher education to embrace a commitment to problem-solving in curriculum and research that draws on disciplinary knowledge and methods but supports the integration of multiple perspectives for interdisciplinary collaboration and education. This shift also requires fostering productive relationships with local and regional communities so that institutions are not islands or towers, but centers of regional engagement and enhancement. We need to focus higher education on "collaborative work, integrative learning, the combination of the intellectual and the experiential, active approaches to learning, problem solving, and, especially, engagement with contested ethical issues and 'big questions'" *(Weissman, 2012, p. 10)*. These things are not only at the core of sustainability literacy, but also at the core of the essential learning outcomes that the Association of American Colleges and Universities (AAC&U) has identified for general education *(Weissman, 2012, p. 10)*. Thus, a retrofit requires the integration of

sustainability literacy and problem-solving skills into not only majors, but also general education.

General education that emphasizes these learning objectives through an interdisciplinary, problem-oriented curriculum, combined with disciplinary training that incorporates interdisciplinary and community engagement into applied learning experiences, such as internships, co-op programs, and service-learning, is not only important for citizens' personal and intellectual development; it is also crucial for solving global challenges that require "adaptive innovation within a changing world" *(Tarrant & Thiele, 2016, p. 55)*. Further, it has the potential to strengthen connections between institutions and their regional communities, preparing students for careers locally and abroad while giving back to their communities in productive, tangible ways.

As campus physical plants adopt Leadership in Energy and Environmental Design (LEED) standards by implementing LEED-certified new construction and LEED retrofits of older buildings, so too should campus leaders be thinking of ways to retrofit their academic infrastructures, curricula, policies, and practices—built on traditional disciplinary models—to be adaptive to the global and local challenges of the 21st century and to produce not only the workers, but also the thinkers, doers, leaders, and problem solvers the 21st century needs. Thus, a retrofit that begins with a transformation of general education to integrate sustainability literacy and top-valued skills, and that fosters and supports interdisciplinary research and educational opportunities for faculty and students, with an emphasis on problem solving that is linked directly to community and industry needs through partnerships, is socially, ecologically, and economically critical.

Hoffman *(2015)* asserts, "Academic scholars have a duty to both recognize the impact of their work on society and communicate that impact to those who must live with the consequences," noting that academics must consider how they can best "make an impact beyond campus walls" *(p. A48)*. Vibrant intellectual inquiry and exploration in all disciplines is vital to cultural understanding and evolution, and thus all disciplines play a role in shaping the way we think about and respond to problems not only in terms of solutions but also through our values, policies, and actions. As centers of inquiry, knowledge production, and innovation, colleges and universities have an obligation to connect with their surrounding communities and contribute to addressing local, regional, and global challenges. Hoffman *(2015)* points out, "If society is to make wise choices, those who create knowledge must move it beyond

the ivory tower" *(p. A48)*. Emphasizing problem-oriented research, education, and collaborations in higher education mission statements and strategic plans opens opportunities for students and scholars of problems to find innovative ways to contribute to their local, national, and global communities.

Why Sustainability, Interdisciplinarity, and Problem-Oriented Education and Research?

To address global challenges, higher education in the United States must adapt to its sociohistorical and political context, and it is in the best interest of individual campus communities to be actively engaged in shaping those adaptations, whether land-grant universities, regional comprehensives, private liberal arts colleges, or any other higher education institutions. It is no coincidence that Mulkey *(2015)*, Rhodes *(2006)*, Weissman *(2012)*, and others have noted connections between the crisis of the university and the global challenges we face in the 21st century. As we prepare this century's leaders, professionals, and citizens, we must take seriously the opportunity and responsibility we have to "evoke societal change and contribute to the creation of new knowledge and paradigms" *(Christie, Miller, Cooke, & White, 2015, p. 655)*. Disciplinary expertise and technical training are only part of the equation. McArthur and Sachs *(2009)* explain,

> The problems are complex and interconnected, spilling across academic disciplines and often across national borders. Solutions will require theoretical knowledge and practical problem-solving skills, including the capacity to build and lead teams drawn from a variety of disciplines. They will require leaders who can cross boundaries of science, policy, geography, theory, and practice. *(p. 26)*

When making decisions about everything from budget cuts to curriculum changes, institutions should position themselves to address sustainability challenges through interdisciplinary, problem-oriented education and research.

College graduates need more than disciplinary training; they need an understanding of "historical experience, social perspectives, moral considerations, and humane reflections of our fellow human beings through the ages" in order to be leaders, innovators, policymakers, and problem solvers *(Rhodes, 2006, p. 71)*. Science and technology are crucial, but their development and application are

guided by systems of values and ethics. Slovic *(2012)* notes that a major challenge to addressing today's problems has to do with our systems of ethics *(pp. 180–181)*. Mulkey *(2015)* calls sustainability education an "ethical imperative," and Christie et al. *(2015)* underscore the "moral imperative" of universities and colleges to prepare graduates with the "knowledge, values, and skills to contribute to an environmentally sustainable society through their personal and professional actions" *(p. 655)*. Leiserowitz and Fernandez (2008) also point out that expertise and understanding are useful only if they can be conveyed and delivered into the public sphere *(p. 62)*. This is where interdisciplinary, problem-oriented general education can play an equally crucial role, by not only preparing students with knowledge, values, and skills, but also providing opportunities to engage and collaborate with the public and greater community.

Is this placing too much responsibility on institutions of higher education? Is it asking too much of our faculty, staff, and students? Hales *(2008)* asserts, "No other societal institution can play this role. Education is the force that will enlighten, enable, and empower our choices" *(p. 23)*. With power comes great responsibility, and opportunity is a kind of power that higher education both offers and creates. Faust *(2009)* reminds us that institutions of higher education in the United States have always had to negotiate tensions between sometimes conflicting goals that span a wide spectrum: "to be practical as well as transcendent; to assist immediate national needs and to pursue knowledge for its own sake; both to add value and question values" *(p. BR19)*. These can be productive tensions that benefit society overall, but they require a commitment to adaptation and to navigating and crossing the boundaries between disciplines.

Like Mulkey *(2012, 2015)*, Rhodes *(2006)* suggests integrating sustainability literacy and associated skills into the core of general education. He explains what such a foundation would look like, citing scientific knowledge, specifically systems-based sciences like ecology; social science training for an understanding of fundamental social interactions; "familiarity with the great issues and themes of human inquiry, self-reflection, and moral consideration that have guided human conduct and reflected human creativity"; and finally, "some review of the practical arts of technical discovery and invention" *(p. 71)*.

Expertise is undeniably essential to addressing challenges across the globe and in our local communities. Because of the complexity of the problems we face, we need interdisciplinary training and collaboration, combined with problem-oriented general education, delivered by institutions that are engaged in research that not

only addresses global challenges but also serves the needs of local communities through productive partnerships. Yet as McArthur and Sachs *(2009)* observe, "at a time when so many of the world's most-challenging issues require solutions drawing from across academic and professional disciplines, colleges remain overwhelmingly focused on single-discipline studies" *(p. 26)*. Thus the question posed by Bursztyn and Drummond *(2014)*: "How can we advance in particularity and in generality at the same time?" *(p. 320)*. This is where the major retrofit needs to happen, and such a paradigm shift, however essential, is fraught with tensions and challenges.

Disciplinary and Institutional Challenges to Implementing the Retrofit

Interdisciplinary, problem-oriented education and research are integral to moving institutions of higher education beyond crisis, preparing our students for the challenges of this century, and producing innovative solutions to complex problems; thus, a comprehensive university retrofit requires cooperation across disciplines, as well as interinstitutional and other types of partnerships. But facilitating interdisciplinary education and conducting interdisciplinary research within most U.S. colleges and universities today is not simple. Bursztyn and Drummond *(2014)* explain,

> As a complex institution that gathers intelligence and rewards it in accordance with strict rules and metrics, [the university] tends to have more room for developing knowledge within given paradigms than for breaking those paradigms. This opens a gap between the need to produce innovations and the ability to innovate and renew itself. *(p. 320)*

The challenges of infusing both general education and disciplinary curricula with sustainability content and skills bring us to the challenges of encouraging interdisciplinary research and teaching. Why? Because economism, combined with what Jones, Selby, and Sterling *(2010)* describe as the reductionist pursuit of knowledge ingrained in higher education policies and practices and embraced by disciplines, inhibits the collaboration and innovations that sustainable solutions require *(p. 18)*.

Indeed, Chandler *(2009)* acknowledges, "The American university's accommodation of shifting patterns in and between the disciplines has been managed unevenly across its several domains from the natural sciences to the humanities" *(p. 730)*. Why is this

kind of change and accommodation so difficult and slow for institutions of higher education? Kurland et al. *(2010)* refer to Weick's 1991 study that argued "universities are loosely coupled systems" *(p. 458)*. Loosely coupled systems "have structural holes" and few interdependencies, which puts them at risk for uncoupling and poses a challenge to any kind of unified change in the system *(p. 458)*. Nonetheless, institutions need to confront this issue openly and directly in order to adapt to 21st-century conditions, identifying structural holes and creating opportunities for productive interdependencies and flexible systems of collaboration.

Several scholars have discussed barriers to adapting higher education to integrate sustainability and interdisciplinarity in teaching and research. These barriers include disciplinary silos; institutional procedures and categories for course approval, curriculum design, and programmatic changes; requirements for retention, promotion, tenure, and merit raises; and faculty workload *(Breen, 2010, p. 688; Weissman, 2012, p. 10)*. In addition, Jones et al. *(2010)* identify reasons for faculty resistance to sustainability education, which apply more broadly to interdisciplinary initiatives as well: faculty's resistance to incorporating new content, stemming from their perception of it as extraneous to their discipline or too value laden; their uncertainty about how to engage interdisciplinary content effectively; and the lack of career incentive for incorporating such content, as well as for collaborating with other colleagues *(pp. 9–10)*. These barriers are all elements of the four key challenges to interdisciplinarity identified by Bursztyn and Drummond *(2014)*: the stigma of generality, the syndrome of refusing otherness, the syndrome of nonpeer evaluation, and the syndrome of external metrics *(pp. 321–323)*. All of these things present challenges not only to sustainability and interdisciplinary teaching and research, but also to building community and industry partnerships and creating and integrating service, experiential, and applied learning into general education and disciplinary curricula for students' professional development.

Stigma of Generality

Interdisciplinary collaboration and the broad generalizing sometimes needed to bridge academic knowledge to the public sphere are difficult to facilitate in a siloed system. The stigma of generality results from a privileging of exclusivity, where literacy in a particular discourse becomes more than a sign of expertise. Amey and Brown *(2005)* acknowledge that the privileging of exclusivity begins with graduate student training:

> They are trained to be experts on the cutting edge of increasingly specialized areas within their chosen discipline, especially if they are interested in research faculty careers. University and disciplinary reward systems, often based on a particularly narrow set of sanctioned behaviors, reinforce these graduate school socializations, keeping many faculty members organizing their work within narrow bands of perceived acceptability. *(p. 30)*

Although deep expertise absolutely contributes to interdisciplinary endeavors, hyperspecialization resulting from a reductionist approach to disciplines can widen the gap between disciplines and between the academy and the public sphere. Likewise, as journals become increasingly specialized, respected venues for publishing interdisciplinary work can be hard to find. Even where a reductionist approach is being replaced by a systems-based approach, reaching the public presents another challenge, as there is a tendency among the general population toward binary and dichotomous thinking that is supported by both traditional and social media. Thus community partnerships become key to building understanding through clear communication and educational outreach.

Disciplinary silos. Leiserowitz and Fernandez *(2008)* point out the limitations of disciplinary silos, noting, "disciplines within academia (natural and social sciences and the humanities) are often isolated from one another. More broadly, too many academics talk only to each other, using language and jargon incomprehensible to even the educated layperson" *(p. 64)*. Citing Bernard K. Forscher's similar 1963 critique in *Science*, Hoffman *(2015)* critiques the increasing push toward disciplinization and "brick making," saying, "Academics find themselves talking to ever smaller and narrower academic audiences, using a language that educated readers do not understand, publishing in journals they don't read, and asking questions they don't care about" *(p. A48)*. And why? Because success and job security (tenure) lie in specialization. Hoffman *(2015)* continues, "Academic success lies in publishing academic journal articles that make incremental contributions to theory, not in summarizing the broader contributions of the community of scholars" *(p. A48)*. Again, the incremental contributions are important, but privileging them over broader contributions risks widening the gap between academia and society.

Because interdisciplinarity requires individuals to collaborate on problems and projects across disciplines, a common language is foundational to progress, especially when working with non-academic partners. However, by building clear communication using discourse accessible to all, interdisciplinary scholars can be perceived as too general, nonspecialized, or superficial *(Bursztyn & Drummond, 2014, p. 321)*. A binary is often set up between specialization (perceived as deep) and interdisciplinarity (perceived as shallow) *(Bursztyn & Drummond, 2014, p. 315*).

Syndrome of Refusing Otherness

In general, universities are set up to offer courses housed under particular disciplines and taught by solo instructors. Not only is there little incentive to diverge from this model, but there are often disadvantages and barriers to doing so. Crane and Chiles *(2011)* note that requirements for teaching, research, and service and associated rewards systems often privilege specialization, and individual disciplines reinforce insular behavior and relationships by supporting only expertise that can result in specialized discourse and structures. Similar barriers still exist for developing or incorporating effective internship or service-learning experiences.

The syndrome of refusing otherness is tied to competition for resources, especially in times of economic instability and financial constraints. Crane and Chiles *(2011)* point out that perceived competition for financial and other resources can lead to unwillingness to collaborate. Additionally, for teaching and research, time is a consideration for both faculty workload and the tenure clock; interdisciplinary course development, outreach experiences, and research collaboration take time to succeed, requiring individuals to engage in dialogue toward common terminology, understanding, and a clear definition of the problem and goals *(Amey & Brown, 2005, p. 31)*. At the higher administrative levels, innovative or interdisciplinary academic units are often rejected or even dismantled under economic constraints because it is believed the work of that unit could be covered by a more traditional disciplinary department.

Developing relevant, interdisciplinary problem-oriented curricula is also challenging. Kilcup *(2009)* observes, "Synthesizing subject-area content, interdisciplinary knowledge, theoretical approaches, and practical experience and making coursework relevant pose intellectual, ethical, pragmatic, and institutional challenges"—especially for faculty and institutions entrenched in a system that does not support, facilitate, or reward interdiscipli-

narity *(p. 848)*. As Kurland et al. *(2010)* found in trying to create and offer an interdisciplinary course, for example, administrative structures and institutional mechanisms (or lack thereof) made it difficult to create and offer a course that transcended disciplinary ownership and for which faculty coteaching the course could be properly credited and compensated *(p. 463)*. Territorial tensions often flare over interdisciplinary courses, and debates over content versus skills with respect to course goals and learning outcomes are not uncommon. Service on a university committee that approves new courses will open one's eyes to disciplinary ownership debates: Who owns sustainability, environmental justice, communication, ethics, environment, society, or pedagogy, and who can use the terms in course titles and include the concepts in course content? The answers are often contentious and hotly debated, and serve to reinforce unproductive barriers to collaboration and innovation within the institution and with the greater community.

Syndromes of Nonpeer Evaluation and External Metrics

The syndromes of nonpeer evaluation and external metrics are connected, both stemming from the fact that evaluators tend to have not only discipline-specific commitments but also discipline-specific perspectives and experiences that they overlay on interdisciplinary units and individuals in the absence of clear interdisciplinary criteria. Resulting evaluations can either reflect, on one extreme, a hands-off approach and lack of care, or at the other extreme, inappropriate scrutiny based in a disciplinary culture that does not apply. Effective peer evaluation and the criteria used for assessment and evaluation are based in shared epistemic communities. Interdisciplinary epistemic communities are growing at the institutional level, but these communities are often nascent at best. For example, "evaluators tend to consider the best aspects of a program are those that have interfaces with their own fields" *(Bursztyn & Drummond, 2014, p. 323)*. Interdisciplinary programs, courses, and research are often compared "to each evaluator's universe of reference" and "end up being evaluated not according to what they seek to be, but according to what they are not" *(p. 323)*. This bias impacts faculty publications and course offerings, as well as applications for internal funding and awards.

Solutions: Retrofitting the Ivory Tower to the 21st Century

Despite these barriers, the challenges that we face present exciting opportunities where a focus on sustainability and interdisciplinary collaboration could result in innovative solutions that are economically advantageous, environmentally beneficial, and socially enriching for universities and colleges, their students, and their greater communities. Adapting to the 21st century necessitates a change in how we create and disseminate knowledge, and how we prepare our students to contribute professionally and personally to society and their communities. This is not the time to pare down to basic concrete skills and eliminate programs and curricula because they do not provide evidence of direct, short-term, quantifiable markers of economic profitability and success. A leaner, streamlined education is not necessarily a more valuable or competitive one. Nor is it the time for faculty to shore up their disciplinary walls against outside attack and critique. We have to be better than that to move toward a more evolved future. Fortunately, there are good models out there for meeting those challenges, and many ideas that can be drawn on and applied to solutions that fit a variety of higher education institutions.

We must work on innovations in general education guided by institutional missions to support the goals of sustainability and the intellectual and skill-based needs associated with solving complex problems. Successful transformation of general education cannot be achieved without clear goals and learning outcomes articulated to students as well as to advisors and faculty. Faculty and higher education institutions must also develop and support pedagogies that apply innovative approaches to teaching and learning at the same time that they prepare students with skills that make them employable and perspectives that make them thoughtful, engaged citizens. Sustainability across the curriculum workshops such as those offered by the Association for the Advancement of Sustainability in Higher Education (AASHE) provide good models for developing and implementing such changes, as well as excellent leadership support. Such pedagogies would also make use of community and industry partnerships, working closely with partners to incorporate applied experiences, complex problem-solving, and cross-course collaboration at the same time that they expose students to multiple perspectives and ethical aspects of real-world issues, history, the arts, and a variety of methodological tools. Students also need more integrated opportunities for internships, co-op programs, and service-learning to help them engage and

see the connections between their education and their work in the world. Building these opportunities and their associated partnerships in local communities fosters professional development as well as community enrichment as both the institution and its neighbors share resources and knowledge.

At the same time, not only must faculty be given the opportunity to address sustainability challenges in their teaching and research, but problem-oriented, interdisciplinary collaborations and public outreach should be incentivized. Higher education institutions are incubators of talent, energy, and innovation, but individuals willing to take these things beyond the institution must be encouraged and supported in doing so. Although these are not new ideas, incorporating them in a coordinated way with clearly articulated learning outcomes and evaluation criteria at a programmatic or institutional level is rare. To do so will require early adopters and volunteers, supported by their administrations and boards of trustees, to collaborate on establishing these new planning documents, goals, outcomes, and assessments, and providing informational and training workshops for faculty and staff.

The retrofit of the ivory tower in practice needs to be tailored to each individual institution and its regional community. What works for a research institution will not be the best fit for a regional comprehensive state university or private liberal arts college. To be truly successful, pedagogical transformation and interdisciplinary collaboration require careful consideration of how individual disciplines link to others, how knowledge and skills transfer to other disciplines and beyond the academy. This intellectual work is critical to moving ourselves and our students toward a social transformation that is ecologically and economically sound as well as socially and culturally just. The most productive and effective adaptations will not be driven by economic models but will come from various stakeholders at institutions and within their communities working together to define shared values and priorities that will shape innovative reforms. Fortunately, there are successful models out there that can serve as inspiration for such changes.

Amey and Brown *(2005)* discuss three stages for developing interdisciplinary collaboration along the dimensions of disciplinary orientation, knowledge engagement, work orientation, and leadership, based on their study of an interdisciplinary group working on a university–community partnership project. As part of its revision of its core curriculum, Unity College in Maine *(n.d.a)* articulated learning outcomes for the environmental citizen, organized into three areas—resourceful individual, engaged citizen,

and environmentally informed graduate. Arizona State University's Institute for Humanities Research *(n.d.)* compiled a list of contributions the humanities make to sustainability, which could be a useful starting point in developing learning outcomes for an interdisciplinary, problem-oriented general education that considers today's global sustainability challenges. The National Leadership Council for Liberal Education and America's Promise (LEAP) *(2008)* has outlined essential learning outcomes as well as seven principles to achieve these outcomes, and these support the kind of knowledge and skills that sustainability and problem-solving require. Tarrant and Thiele *(2016)* provide a summary of sustainability education learning outcomes developed by Tillbury *(2011)*, Wals *(2012)*, and other sources *(p. 55)*. They synthesize these outcomes to provide the following core set of sustainability skills:

- critical thinking and systems thinking skills, which facilitate investigative, integrative, and holistic thought, navigation between tradition and innovation, and the clarification of values; and
- communication and collaboration skills, which facilitate the empowerment of students as adaptive and interactive lifelong learners, stewards for conservation, and agents of change. *(p. 55)*

When developing learning outcomes, it is important to clearly define skills and content objectives tied to programs and institutional missions, and to develop concrete, meaningful assessment that aims for connective transparency between content and associated skills. For example, Williams *(2015)* addresses the ubiquitous "critical thinking," defining it as "the highly valuable inquiry and interrogation prerequisite to problem identification; it involves the analysis of an argument's merits and faults. It is the process of judging, approving or disapproving." He argues that in addition to critical thinking, we need to educate students in *constructive* thinking. He explains, "The identification of problems made possible by critical thinking is useful only if it gives rise to the *problem solving* of constructive thinking. The desired endgame is problem solving, not critical thinking for its own sake" (emphasis in original).

In addition to critical and constructive thinking skills, many proponents of sustainability education, like Tarrant and Thiele *(2016)*, emphasize the need for systems thinking, or "a basic capacity for recognizing and understanding complex situations in terms of their boundaries, drivers, adaptive processes, and the direct and

indirect interactions of their component parts" *(p. 58)*. Wood *(2012)* also calls for an emphasis on systems literacy, "interdisciplinary research practice and pedagogy that calls for intellectual competence (not necessarily command) in a variety of fields" *(p. 4)*. Such skills can be introduced through general education content in a variety of ways, and certainly align well with the goals of many disciplines.

As noted earlier, the discussion of skills versus content can cause tensions, and Berrett *(2016)* addresses the challenges that disciplinary content experts can face when expected to also deliver transferable skills. However, he cites Emory University's successful initiative to develop curriculum around transferable skills without content becoming a mere conduit for skills. In its "campuswide skills-teaching effort," Emory focused on using and evaluating evidence, offering 27 first-year seminars across more than 20 departments. Berrett *(2016)* notes, "As different as disciplinary definitions of evidence may be, faculty members here say the effort has given them a curricular focus and shared vocabulary, allowing them to discuss teaching and learning in new ways."

The initiatives at institutions like Unity, Emory, and others show that we can retrofit the ivory tower to the 21st century. Disciplines and interdisciplinarity can coexist and strengthen each other. Courses can offer content expertise and transferable skills, and universities can coordinate across their campuses to develop shared values and general education learning outcomes that are socially relevant. For example, an interdisciplinary, problem-oriented general education course should consider multiple goals—what knowledge and methods can each discipline contribute to identifying, understanding, and solving a particular problem? How can the course introduce students to this while also providing opportunities to learn and apply skills such as critical, constructive, and systems thinking, teamwork, and communication while encouraging the development of the personal traits of self-reflection, ethical integrity, and a commitment to inquiry?

Beyond general education, a retrofit could also spur productive innovations in individual departments and graduate education. For graduate students in particular, Moslemi et al. *(2009)* found that there is often an insufficient focus on professional development for nonacademic careers, due to a variety of factors such as lack of funding incentives, no structure or support (academic or financial) in place to facilitate the completion of an internship plus thesis or dissertation within a reasonable time frame, and lack of an administrative structure for setting up internship options *(p. 519)*.

Supporting our students in their professional development makes them more successful by helping them make relevant connections between their education and their careers, and introducing them to a variety of career opportunities. Individual departments can also draw on available models to tailor changes to their own disciplines, careers, and community connections, and find ways to work with other relevant departments on interdisciplinary opportunities that include applied experiences outside the institution.

Bursztyn and Drummond *(2014)* propose the star model as an innovative framework that has the potential to integrate disciplines in ways necessary to true interdisciplinary research initiatives *(p. 314)*. They found that when research efforts aimed to be comprehensive "rather than problem-oriented . . . the result was indeed inevitably shallow" *(p. 315)*. However, a problem-oriented focus geared toward "addressing of a complex problem and then searching for the various disciplinary contents that could answer it" leads to more rigorous, substantial results *(p. 315)*. The key for each individual contributor is to begin by working from within that individual's disciplinary training and expertise, bridging into other areas in search of contributions from other fields once that foundation is firmly established *(pp. 315–316)*. Approaches must be grounded in the theoretical and methodological frameworks of disciplines that then contribute to the larger complex problem—research must build on and connect to other work, laying a foundation and not simply making bricks, but contributing solid, quality bricks to a larger, cohesive structure.

Bursztyn and Drummond *(2014)* suggest that universities and colleges might look to problem-oriented nonacademic research institutions (NARIs) for models of how to organize interdisciplinary programs and research groups as epistemic communities. A problem-oriented approach that addresses larger issues like climate change and food security yet also bridges with communities, businesses, and nonprofits to address these and other local issues can both provide applied education for our students and build social capital between institutions and their communities. We need not only to suffuse disciplines with sustainability awareness, but also build interdisciplinary teams of researchers that bring appropriate disciplinary methodologies and knowledge to sustainability problems. Prioritizing such an approach can also, as Bursztyn and Drummond *(2014)* note, enhance "the legitimacy and usefulness of University output" *(p. 323)*.

With major funding agencies supporting problem-oriented research that requires interdisciplinary collaboration, institutions

of higher education would also benefit from having at least one grants specialist on staff who knows the strengths and expertise of the institution, its faculty, staff, and students; can identify grants that match those strengths and even regional needs; and can build interdisciplinary teams of faculty, students, and staff, essentially spearheading the process and catalyzing the kinds of collaborations local and global sustainability challenges require. Sam Houston State University is one example of an institution that created such a position several years ago and saw a significant increase in grant-generated funding as a result. Creating at the institutional or college level a position or positions dedicated to grant prospecting, writing, team building, and development can not only increase an institution's pursuit and acquisition of grants, but also support and facilitate interdisciplinary research and education while developing meaningful partnerships outside the institution and raising the institution's impact in the community and the public sphere.

We need progressive reform in general education curricula; disciplinary curricula; pedagogical approaches; retention, tenure, and promotion criteria and procedures; and criteria for recognition and career advancement. We need faculty, administrators, and governing units to educate themselves on sustainability and interdisciplinarity, focusing on how each is defined, understood, and practiced on their campuses, or how they could be integrated to enhance the institution's mission and success. To achieve reform, we need campuswide discussions, as well as professional development focused on sustainability, interdisciplinarity, and problem solving, with respect to content, pedagogy, and learning outcomes. By extension, administrators, faculty, staff, students, and communities need to reflect on the ethical integrity of their mission and need to understand higher education as more than a business. These reforms should not be imposed in ways that infringe on intellectual freedom—personal teaching and scholarship. But it is hopeful that an increasing number of faculty, supported by their administration, will voluntarily consider the social relevance of their work and seek new ways to partner with their communities and collaborate in teaching and research. In fact, working with all stakeholders to develop adaptations will result in stronger investment by the university or college and surrounding community. Administrators need to familiarize themselves with the issues and find ways to use interdisciplinary, problem-oriented research and education to address fiscal challenges in innovative ways. Leaders of professional organizations must also encourage discussions regarding these issues at professional meetings and in their associated journals find

ways better to facilitate and support problem-oriented research and reduce disciplinary barriers that hinder interdisciplinary innovations, while maintaining academic rigor.

Conclusion

In 1977, Lovins warned, "We must be wary of the danger of not being imaginative enough to see how undetermined the future is and how far we can shape it" *(cited in LeMenager and Foote, 2012, p. 577)*. Institutions of higher education are valuable incubators for inquiry, discovery, and innovation, and are essential to critically challenging dominant views to prevent narrow or limited thinking. Faust *(2009)* emphasizes, "Higher education is not about results in the next quarter but about discoveries that may take—and last—decades or even centuries" *(p. BR19)*. Addressing global and local challenges requires innovation, collaboration, and a long-term view that weighs economic, social, cultural, and environmental interests.

Mulkey *(2012)* asserts, "Like much of America, higher education must get its head out of the 20th century and leave behind inappropriate business models" *(p. 357)*. An economically driven model is not a balanced one. Like global sustainability challenges, the university crisis will require major changes to resolve. Driving these changes must be a willingness to prioritize an interdisciplinary, problem-oriented focus within education and research that facilitates and supports community and industry partnerships to address the increasingly complex global and local needs of the 21st century.

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