

Overview: Sustainability Education Framework

“Sustainability” has emerged as a goal and principle that is defined in multiple ways across different disciplines and has become the focus of a wide range of academic programs that articulate a range of essential learning components. While specific definitions of sustainability differ across disciplines, sustainability is motivated by the fundamental dependence of humans on the natural environment.¹ An understanding of human and natural systems and their interdependencies is the cornerstone of sustainability education. Rather than attempting to distill a single definition of sustainability, SELC collected and synthesized various definitions of sustainability (see below) and embraces multiple definitions as they represent different, but essential, dimensions of sustainability. These are represented by the six dimensions framework that SELC has used to classify programs and courses at Ohio State.

Figure 1 presents a conceptual framework for a comprehensive approach to sustainability education at Ohio State that informed SELC discussions. Referred to as “The Four-Leaf Clover” of sustainability education, this figure illustrates four broad areas of inquiry: physical and natural sciences; social sciences, business, law and policy; engineering and planning; and humanities and arts. These knowledge domains provide the foundation for sustainability education and their overlaps are the basis for interdisciplinary education and training. While curricular programs commonly have a core focus in one of four knowledge domains, sustainability requires some level of integration of this core. SELC spent considerable time early on discussing where existing undergraduate academic programs should be placed within this framework and in what ways this framework provides insights into potential opportunities for new curricula. This exercise provided initial guidance in terms of existing programs and gaps (**Appendix C**). For example, a clear gap that emerged is the lack of integration of humanities and the arts with other areas.

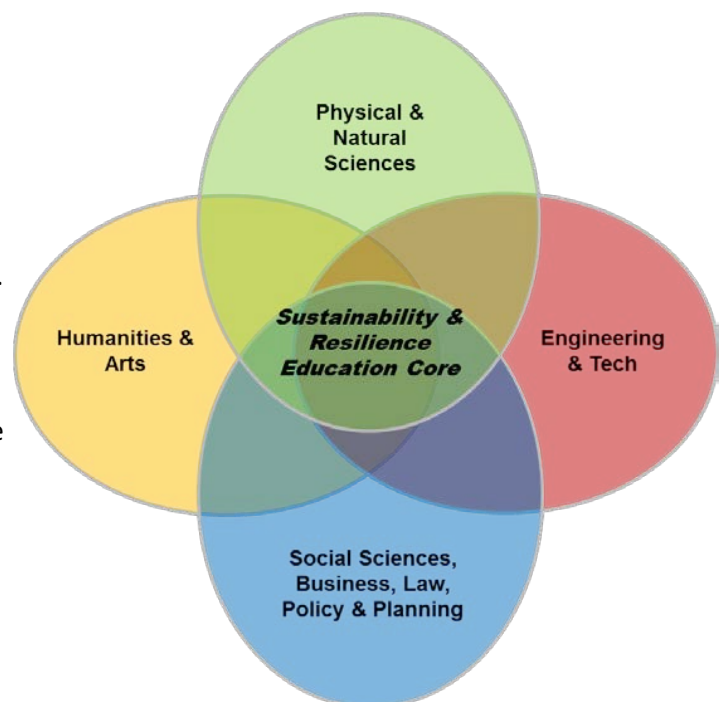


Figure 1: The Four-Leaf Clover: A Conceptual Framework for Sustainability Education at Ohio

¹ “Sustainability is the improvement of the well-being of people and communities in ways that protect the earth’s life support systems by reducing environmental impacts, enhancing resource efficiency, and ensuring economic prosperity for all. It is motivated by the fundamental dependence of humans on the natural environment and the desire to foster life on Earth now and in the future. Sustainability also depends on the resilience of natural and human systems, such as those providing energy and food, and the ability of communities to recover, adapt, and flourish in the face of changing environmental, economic, and social conditions.” – Sustainability Institute Strategic Plan. Available online: <https://oaa.osu.edu/sites/default/files/uploads/unit-level-strategic-planning/strategic-plans/sustainability-institute-strategic-plan-2019.pdf>

Six Dimensions of Sustainability

The Four-Leaf Clover diagram provides a holistic representation of sustainability education based on the underlying disciplinary areas but does not articulate the central topics or thematic areas of sustainability. To more explicitly represent the subject matter of sustainability education, SELC distilled the various facets of sustainability from core concepts of the scholarly definitions into a set of keywords that were further grouped into the six thematic areas. The six thematic areas identified are as follows:

1. **Human and Natural Systems:** coupled human-natural systems, integration of environmental, economic, and social factors, systems thinking, resilience of human-natural systems, changes in these systems over time
2. **Earth and Environmental Systems and Sustainability:** environmental, earth, and natural resource systems; knowledge of planetary or natural systems, e.g., climate, aquatics, soils, forests, wildlife, geology, ecology, agriculture; AND how these relate to human well-being and sustainability or are impacted by human activities
3. **Economy, Governance, and Sustainability:** economic, political, business, and policy processes, including economy, consumption, production; laws, policy, institutions; business, strategy, management; costs, benefits, tradeoffs; AND how these relate to sustainability or are impacted or constrained by environmental conditions
4. **Society, Culture, and Sustainability:** social and cultural processes, including justice, equity, values, and ethics; history, religion, and the arts; citizenship; behavior and decision making; power and cultural critique; AND how they relate to sustainability or the environment
5. **Sustainable Engineering, Technology, and Design:** engineering processes; technological innovation; systems design; infrastructure and built environment; human-machine interface; manufacturing processes; life cycle; product design; AND how these relate to sustainability, including promoting human well-being through lower environmental impacts, greater resource efficiency, or improved resilience
6. **Health, Well-Being, and Sustainability:** human health, safety, risk, sustainable livelihoods, social welfare and well-being for a community or globally, changes in well-being over time AND how these are impacted by environmental conditions

This classification provides the basis for SELC's Six-Dimension Framework that provides a multidimensional categorization of the content of sustainability programs and courses and a richer summary of sustainability content relative to other schemes. To operationalize this framework, SELC developed a classification scheme for both individual courses and academic programs that categorizes the relative amount of course or program content for each of these six thematic areas. The six dimensions framework communicates the breadth of Ohio State's sustainability programs and provides an information tool for students as they seek certain types of training or study. **SELC sees considerable potential in this framework to provide a basis for inventorying and communicating Ohio State's sustainability education programs, including in student advising and identifying curricular gaps.**

Background: Sustainability Education and Definitions

Sustainability Definitions. Key elements of **recognized scholarly definitions** of sustainability include the following concepts:

- Sustainability is a condition that allows humans and other species to flourish and thrive in perpetuity within Earth's carrying capacity, and not unjustly burdened by the actions of others²
- Sustainability involves a triple bottom line that balances environmental impacts, economic gains, and social well-being³
- Sustainability means staying within critical ecosystem and environmental boundaries, including planetary boundaries that define a "safe operating space" for humanity⁴
- Sustainability also depends on the resilience of natural and human systems, such as those providing energy and food, and the ability of communities to recover, adapt and flourish in the face of changing environmental, economic and social conditions.
- Sustainability suggests non-declining human welfare or well-being; using resources in a way that maintains or improves the well-being of communities and global society
- Sustainability is inherently complex and political, often contested, shaped by real-world processes influenced by relations of power, and is normative because it is value-laden⁵
- Sustainability implies meeting the needs of the present without compromising the ability of future generations to meet their own needs⁶

Considering these complex and multi-faceted elements involved in sustainability, there are also a wide range of **essential components recognized by multiple disciplines engaged in sustainability education**:

- Holistic, interdisciplinary educational approaches that foster synthesis and systems-thinking skills
- Focus on the interfaces between human and natural systems (coupled human-natural systems)
- Curricula include key concepts from natural, social, or applied sciences and humanities
- Promote understanding of both sociopolitical and natural aspects of environmental problems, the limits of technology and science, and the importance of acknowledging and reporting uncertainty
- Include attention to the role of values and policy within cultures, and the importance of philosophical perspectives on 'progress' and 'well-being'
- Critical appraisal of "problem-solving" approaches, to think differently about complex problems and solutions, and educating to avoid problems in the first place
- Critical perspectives on culture that question dualistic, hyper-rationalist or other constructs that shape science, technology, and culture as though human and natural systems are separate, and nature and culture opposed

² Bullock, C. and Hitzhusen, GE. (2015). Participatory Development of Key Sustainability Concepts for Dialogue and Curricula at The Ohio State University. *Sustainability* 7(10), 14063-14091; doi:[10.3390/su71014063](https://doi.org/10.3390/su71014063)

³ Elkington, J. (2004). Enter the triple bottom line. In A. Henriques & J. Richardson (Eds.), *The triple bottom line: Does it all add up?* (pp. 1-16). London, England: Earthscan

⁴ Rockström, J., et al. 2009. Planetary boundaries:exploring the safe operating space for humanity. *Ecology and Society* 14(2): 32. [online] URL: <http://www.ecologyandsociety.org/vol14/iss2/art32/>

⁵ Mansfield, B (2009). Sustainability. In N Castree, D Demeritt, B Rhoads, and D Liverman (Eds), *The Companion to Environmental Geography* (pp. 37-49). London: Blackwell.

⁶ Our Common Future (Brundtland Report) by the World Commission on Environment and Development (1987)

An earlier report on environmental programs in higher education (2011)⁷ suggests **four core competency intentions** of effective interdisciplinary environmental programs, which we adapt here as guidance for sustainability programs:

- Develop sustainability-minded citizens
- Prepare sustainability professionals to be problem solvers
- Train sustainability scientists
- Educate sustainability integrators

At Ohio State, we support a comprehensive array of programs that address sustainability, connecting across broad domains of natural sciences, social sciences, engineering, and humanities, to empower a diverse selection of multi-disciplinary and disciplinarily focused sustainability programs.

Undergraduate Survey: Six Dimensions Framework for Sustainability Program and Course Evaluation

Data Collection (Fall 2019-Winter 2020)

- Using an Excel tool, academic units were asked to report the relative amount of content for each of the six categories above in their sustainability-related academic programs. For each of the six dimensions, they assigned a value between 0-100.
 - 100% = This is a primary focus of the program, e.g., two or more of the ELOs and a required course are focused on this area of sustainability.
 - 75% = This is a clear focus of the program, e.g., at least one ELO or required course is focused on this area of sustainability.
 - 50% = There are no ELOs or required courses in this area, but the program offers multiple courses (5 or more for a larger program, 3 or more for a smaller program) or other learning opportunities, e.g., internships, education abroad, minors, certificates, in this area of sustainability.
 - 25% = There are no ELOs or required courses in this area, but the program offers 2-4 courses in this area.
- For courses, academic units were asked to simply classify their courses by entering “P” or “S” indicating which of the six dimensions are addressed via the content of each specific sustainability-related course at a “Primary” or “Secondary” level.
 - “Primary” = At least one Expected Learning Outcome or at least half of the overall course content is focused on this dimension of sustainability
 - “Secondary” = At least one segment (multiple sessions of the course), but less than half of the overall course content is focused on this dimension of sustainability

These data are available on SI’s website: <https://si.osu.edu/learn>

⁷ Vincent, Shirley. 2011. Interdisciplinary Environmental Education: Elements of Field Identity, Core Competencies, and Curriculum Design for Higher Education.