Appendix C. Sustainability Competencies and Pedagogies Handout

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Competency	Definition	Example Pedagogies
Systems thinking	UNESCO: The ability to recognize and understand relationships, to analyze complex systems, to think of how systems are embedded within different domains and different scales, and to deal with uncertainty. KCSF: The ability to collectively analyze complex systems across different domains (society, environment, economy, etc.) and across different spatial and temporal scales (local to global; past, present, future), thereby considering change agents, cause-effect structures, cascading effects, inertia, feedback loops, and interdependencies as well as other systemic features related to sustainability issues.	• **Games, simulations, and models** to explore patterns, cause and effect, and change under different circumstances. • **Case studies or current news stories** to identify transparent and hidden connections. Local and global examples to highlight the interconnectedness. • **Institutional analysis** to review existing practices, mechanisms, and procedures. • **Group discussions** to identify hidden and visible flows.
Anticipatory thinking Futures thinking	UNESCO: The ability to understand and evaluate multiple futures – possible, probable, and desirable; to create visions for the future; to apply the precautionary principle; to assess the consequences of actions; and to deal with risks and changes. KCSF: The ability to collectively explore future developments and states, specifically to anticipate how sustainability problems might evolve or occur over time (scenarios), considering concepts such as inertia, path dependencies, and triggering events. It also includes the ability to collectively analyze, evaluate, and craft rich "pictures" of future visions, which provide a foundation for researching evidence-supported alternative development pathways.	• **Journaling** to reflect on the consequences associated with certain choices. • **Scenarios** to develop alternative ends or map out possible outcomes. Scenarios can be written, visual, auditory, embodied, kinesthetic, and/or verbal. • **Macrohistory** to seek patterns of change or consider historical trends.
Normative Values thinking	UNESCO: The ability to understand and reflect on the norms and values that underlie one's actions; and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge, and contradictions. KCSF: The ability to collectively identify values and to map, analyze, and specify values, as well as the ability to apply, reconcile, and negotiate sustainability values, principles, goals, and targets, as well as trade-offs. As sustainability is an inherently normative concept centered on intra- and intergenerational justice and equity among people and between people and the environment, values-thinking competency includes engaging principles and practices emphasizing justice, equity, diversity, and inclusion.	• **Modeling good practice** to demonstrate a strong sense of fairness and social justice in the classroom for performance beyond the classroom. • **Debates and group discussions** to ask questions, clarify and analyze their values, and explore others' values in a safe space. • **Active listening/participation and role-play** to understand another person's perspective. • **Culturally responsive teaching** to ensure topics are appropriate for the grade level, culture, and community. • **Diversity/global learning*** to explore cultures, life experiences, and different worldviews.

Competency	Definition	Example Pedagogies
Strategic Strategic thinking	UNESCO: the ability to collectively develop and implement innovative actions that further sustainability at the local level and further afield. KCSF: The ability to collectively design and plan to implement transformational (systemic) interventions, transitions, and transformative governance strategies toward sustainability while accounting for strategic leverage points, power dynamics, uncertainty, surprises, and social and organizational learning in navigating these strategies.	• **Inquiry- and project-based instruction,** such as designing, evaluating, and adapting policies, programs, action plans. • **Place-based learning** to address real-world problems and solutions. • **Reflections** to evaluate personal and group progress. • **Games and puzzles** to analyze and test strategies and contingency plans for unintended consequences. • **Mapping** intervention strategies to build the necessary knowledge and skills to create change.
Collaboration Interpersonal	UNESCO: The ability to learn from others; to understand and respect the needs, perspectives, and actions of others (empathy); to understand, relate to, and be sensitive to others (empathic leadership); to deal with conflicts in a group; and to facilitate collaborative and participatory problem-solving. KCSF: The ability to motivate, enable, and facilitate collaborative and participatory sustainability research and collective problem-solving processes. Additionally, interpersonal competency is the ability to facilitate collective and inclusive co-production of knowledge and collaboration across academic disciplines (interdisciplinary collaboration), between academic and societal communities (transdisciplinary collaboration), and across diverse ways of knowing (epistemologies) and being (ontologies).	• **Collaborative assignments and projects*** to learn how to work with others to analyze and solve problems. • **Intensive writing*** to produce and revise various forms of writing for different audiences in different disciplines. • **Community-Based Learning*** to provide direct experience with issues, apply what learning in real-world settings, analyze and solve community problems, and reflect.
Critical thinking	UNESCO: The ability to question norms, practices, and opinions; to reflect on one's values, perceptions, and actions; and to take a position in the sustainability discourse.	• **Stimulus activities**, such as viewing or making creative works, initiating reflection or discussion. • **Critical reading and writing** to analyze viewpoints, futures, and values. • **Fieldwork** to link theory to real-world examples.
Self-awareness Intrapersonal	UNESCO: The ability to reflect on one's role in the local community and (global) society; to continually evaluate and further motivate one's actions; and to deal with one's feelings and desires. KCSF: The ability to consciously and proactively engage as a change agent for sustainability. This involves being aware of one's own emotions, desires, thoughts, and behaviors, as well as one's positionality in society and one's role in the local community and (global) society. Building on this, intrapersonal competency involves the ability to reflect and act on that self-awareness and to regulate, motivate, and continually evaluate one's actions and improve oneself, drawing on competencies of emotional intelligence.	• **Critical incidences** to consider personal perspectives and actions in light of an ethical dilemma. • **Reflexive accounts** to consider personal roles, attitudes, and responsibilities concerning sustainability issues. • **Personal development planning (PDP)** to reflect on learning, performance, and achievement and to plan for personal, educational, and career development. • **ePortfolios*** to electronically compile work, reflect on growth, and share items with professors, advisors, and potential employers.

Competency	Definition	Example Pedagogies
Integrated problem-solving	**UNESCO:** The ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive, and equitable solution options that promote sustainable development, integrating the other competencies. **KCSF:** The ability to select an appropriate problem-solving framework developed for complex sustainability problems and to apply the selected framework to collective approaches that jointly develop viable solution options as a result of meaningfully integrating problem analysis, sustainability assessment, visioning, and strategy-building and to jointly plan to implement the co-created solution options on the ground.	**Problem-based learning** to research issues, develop action plans and evaluate processes. **Undergraduate research*** to involve students in addressing contested topics, empirical observation, technology development, and excitement from working to answer important questions.
Implementation	**KCSF:** The ability to collectively carry out and realize (on the ground) a planned solution over time, working toward a sustainability-informed vision. This involves collaborating with others to monitor and evaluate the realization process and address emerging challenges (adjustments), recognizing that sustainability problem-solving is a long-term, iterative process between planning, realization, adjustment, and evaluation.	**Capstone projects***, such as a research paper, a performance, or an art exhibit, to integrate and apply previous learning. **Internships*** to provide students with direct work experience and to give them the benefit of supervision and coaching from professionals. **Social action projects** that provide students with opportunities to advance a plan of action they developed on campus, in a community, or in local, state, national, or global policy arenas.

NOTES

UNESCO definitions of competencies are adapted from UNESCO (2017). Key Competencies in Sustainability Framework (KCSF) definitions of competencies are from Brundiers et al. (2023); see also Brundiers et al. (2021), de Haan (2010), Rieckmann (2012), Wiek et al. (2011), and Wiek et al. (2016).

Pedagogies are adapted from AAC&U (n.d.), Cotton & Winter (2010), Daffron & Caffarella (2021), and Warren et al. (2014).

* Denotes high-impact learning practices identified by AAC&U (n.d.).

An online tutorial on the KCSF sustainability competencies for instructors and students is at sites.google.com/asu.edu/gcselevel1/home and an introductory portal is at keycompetencies.sustedu.org/#