Summary of AASHE workshop Key Competencies in Sustainability: Curriculum and Program Development   Friday 5-October, 2018

With a diverse, engaged and thoughtful group of participants, we had a fruitful set of conversations on discussing and refining core competencies in sustainability[1]. Although we were unable to meet all the objectives of those participating, the workshop did identify ways to improve the continued development of key competencies in sustainability.

A diverse range of environmental-, social-, and sustainability science professionals and academics from both traditional and transdisciplinary programs engaged in our dialog. As a result of this diversity, some types of common vocabularies and concepts needed to be established to allow constructive dialog. We must reduce the ambiguity of specific terms including competencies, learning outcomes, activities, methods, strategic and tactical approaches. To this end, we are developing a glossary that we will make available to all participants.

The goal of the workshop was to establish some *consensus on core competencies* at the most fundamental level: what are the knowledge, skills, abilities and attitudes we want our students to learn to effectively address sustainability challenges?

Discussion during the workshop highlighted the need to focus on how we can help students connect their learning activities to the development of concrete competencies with respect to sustainability problem-solving efforts (e.g., building literacy in sustainability competencies).

Box-1: Related Information added during write-up as supplement to the discussion

For instance, in a first step, students learn to define competency and to explain some its key concepts and methods. On this basis, students then are able to apply concepts and methods in their projects. This type of sequencing of learning objectives is in line with current research on learning objectives. For instance, Bloom's revised taxonomies on learning objectives combines six stages of cognitive processes (to remember, understand, apply, analyze, evaluate, create) with different ways of knowing (factual, conceptual, procedural, metacognitive knowledge). For details see the information compiled by Iowa State University's Center for Excellence in Learning and Teaching (http://www.celt.iastate.edu/teaching/effective-teaching-practices/revised-blooms-taxonomy) .

The Real-World Learning Experience Model illustrates this sequencing of learning objectives to enable students (over the course of two or four years) to develop the abilities and skills needed to work collaboratively with community partners. In their final capstone sustainability project, students bring to bear what they have learned about academic skills, key competencies in sustainability, and topical sustainability issues (e.g., social justice, economic viability, and ecosystem dynamics as well as methods such as actor-network analysis, greenhouse gas inventories, and cost-benefit analysis).
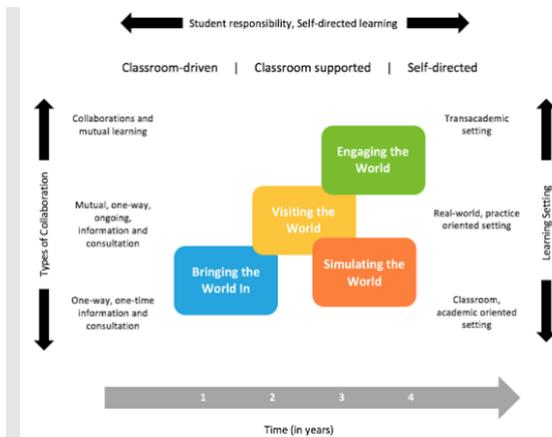
For every stage, there are learning/teaching activities provided. Each learning/teaching activity is available as a downloadable PDF providing an example and an assignment template, as well as the core competencies in sustainability that this assignment helps to build.

https://sustainability.asu.edu/real-world-learning/

Because participants were very interested in these connections, we present this additional resource: the research results from a multi-year research program called "Educating Future Change Agents." This research program focuses on key competencies in sustainability analyzing and evaluating K-12 teacher education and higher education sustainability programs in an international perspective.

In addition to making strong connections between activities and competencies, there was consensus that the range, or at least definition of identified core competencies needs to be expanded. The following suggestions were brought forward and offered food for thought how to address the proposals in order to build on and expand the existing bodies of work.

- Stimulating, recognizing, and utilizing **creativity** plays such an important role in addressing sustainability challenges that it should be considered as a separate, but linked competence.

  [**Related information added during write-up as supplement to the discussion**:
  Note, "creativity" is already included in the core competencies framework by Wiek et al. (2011) referencing the work of several scholars, including Sipos (2008) discussing creativity as a general humanist quality for students in sustainability; de Haan (2006), Barth et al. (2007), and van Dam-Mieras et al. (2008) discussing creativity, fantasy and imagination as key abilities supporting futures thinking competence, and Sterling (1996) discussing creativity as ability for interpersonal competence. Considering that creativity is mentioned as integral element of two core competencies in sustainability, the question for us becomes what justifies to define creativity as a core competency on its own.]

- The need to reach out beyond traditional perspectives and to enhance diverse approaches to sustainability challenges should require developing competence in **biocultural regeneration** (e.g. indigenous knowledge or 7th generation thinking). Our approaches are often divorced from a place-based culture that was indigenous at some point in time. This culture provides a critical perspective on human and environmental connections. In many cases we have lost this context for examining sustainability decision-making, and should restore it.

  [**Related information added during write-up as supplement to the discussion**:
  This proposal draws together three core competencies: **Values thinking competence** (e.g., values of a place-based culture, values related to ensuring long-term care and maintenance of

environmental and human resources, and values of Native tribes) with **future thinking competence** (e.g., 7-generation-thinking concept/method, combining knowledge of our past generations (great-grandparents, grand-parents, parents, with knowledge of our future generations of children, grandchildren, great-grandchildren), with **strategic thinking competence** (e.g., qualified leadership, community established legal and political institutions and procedures). [1]

The discussion also explored these questions:

At what level is it useful to students to understand the concepts of the core competencies they are working toward?

When is it appropriate to engage students with the mechanics of developing competencies, how should we engage them in a conversation about core competencies in sustainability as learning outcomes, and how should we engage students in the pursuit of activities that will help them achieve these competencies?

While we were unable to answer these questions, the discussion resolved that we need to do it deliberately at some level(s). In syllabi, make sure learning objectives are in usable form. Make it clear to students that there is a structured and thoughtful learning process. Instructors can act as deeper mentors. Furthermore, it seems important to get students doing immediately and save reflection on the nature of their studies for later in the curriculum. Consider in each class having the same pre- and post-class case study/scenario. Learners then see what resources they brought to the problem at first and what additional resources they added by the end of course. Learners can understand what resources (knowledge, skills, abilities, values) they gain without necessarily understanding the context of this learning in developing specific competencies. This context can be developed after students are engaged in the activities.

Additionally, there was substantial discussion about using the term "problem solving" with care. By definition, we can't "solve" wicked problems but we can reduce levels of the problem and work towards transforming the structures that create the problems. There was discussion about considering a term like **change making, benchmarking, piloting/navigating, implementation skills**. The term used may have more or less inspirational utility. For example, solve sounds stronger than reduce.

We then discussed in small groups and then in the whole group the strengths, weakness and omissions of concepts and methods within specific competencies.

The term "methods" caused some confusion. In the presentation of the competencies, pertinent concepts and methods are presented. Concept refers to the theories, frameworks and concepts that explain the substantive content of competences ("what is it?"). Methods refer to procedural approaches ("how to do it?"). For instance, methods pertinent to values-thinking include multi-criteria assessment methods; in futures-thinking competence methods include backcasting or scenario-construction. It is possible to design an assignment that engages students in employing a

[1] David E. Wilkins, Jun 18, 2015: How to Honor the Seven Generations. Indian Country Today. https://newsmaven.io/indiancountrytoday/archive/how-to-honor-the-seven-generations-0UNiIfbN5UOL36SXV6rIiQ/

method, e.g., design and implement a visioning workshop with stakeholders. This assignment will help students to build future thinking competence as well as interpersonal competence, which might be part of the students' program level learning outcomes. Applying a method also implies that students understand what thinking in structured ways of the future means (= concept of futures thinking).

Competency Menus, including Concepts & Methods

Please note the Competencies Menus presented on the slides during the workshop included only selected examples from the menu of concepts and methods listed in the literature review by Wiek et al. (2011).

Values competence
Select examples for concepts (in bold black) Our reflections from workshop (in red)

Concepts of…
- **What is or is not sustainable, now and in the future**
    - What do we mean by sustainable into the future, how do we balance that concept with other "values" such as consumption, freedom from want etc.
- **Sustainability principles, goals, targets and thresholds (tipping points) and leverage points**
- consider multi-cultural values and cultural humility as a major category.
    - People's decisions are guided by factors beyond their specific perceptions. There are both implicit and explicit norms in sustainability that need to be recognized. How can people better recognize hidden values affecting their decisions?
- **justice, fairness, responsibility, safety, happiness, ethics, risk, harm, loss, damage**
    - need to define these terms, utilize **the humanities** in this process of defining these concepts now and in a more sustainable future
    - Including non-western concepts in these definitions
    - **Beauty** as a value
    - **Empathy** as a value [note: empathy is included as a skill in the core competency of interpersonal collaboration]
- **What constitutes "win-wins" and tradeoffs and for whom**
    - Different values systems may have different consequences now and/or in the future.
    - How do we weigh the consequences of particular actions?
    - When consequences of a particular action lead to conflicting values, how do we rank their importance?
- **Concepts of ethics**

The discussion also highlighted how core competencies work together or overlap, e.g.,
- Overlap of values with intrapersonal and interpersonal competence: Empathy can be a value in the culture of an organization; students learning "perspective taking" (employing this method to practice empathy) develop the skill of being empathetic, which supports interpersonal collaboration.

- Visioning is a method that combines futures thinking with explicit values and things that people want (different people might want different things). A vision can be developed for, say, a municipality in the year 2020, or, say, for a city in the year 2040. Visions can be based in systems thinking in order to scale ideas over time and space. Impacts of visions on people, ecosystems, resource availability etc. can be assessed using e.g., multi-criteria analysis.

Select examples of methods pertaining to values thinking competence (in bold black) Our reflections from workshop (in red)

- Multi-criteria assessment methods (normative component of assessment methods, including Life-Cycle Assessment, Multi-Attribute Utility Theory, etc.)
- Multi-criteria assessment methods
- Risk analysis
- Sustainability assessment
- Sustainability efficiency analysis
- Visioning methods (backcasting, 2nd module)
- Participatory methods (negotiation methods, consensus conference)

Systems thinking competence
Select examples for concepts (in bold black) Our reflections from workshop (in red)

Concepts

- Complexity
- Variables/ indicators, clusters, sub-systems, structures, functions
- System characteristics: Feedback loops, complex cause-effect chains, cascading effects, inertia, tipping points, leverage points, legacy, resilience, adaptation, structuration
- Across/multiple scales: local to global
- Across/multiple/coupled domains: society, environment, economy, technology, etc. not just biophysical systems: in addition to matter and energy
- People and social systems, consider values, preferences, needs, perceptions, (collective) actions, decisions, power, tactics, politics, laws, institutions, etc.
- Explicitly demonstrate hierarchy as part of structure

We also discussed methods related to systems thinking including for instance:
- agent-based modeling and actor-network modeling as methods for systems modeling. The social sciences and humanities can help inform these methods.

Another discussion pertained to communicating systems, linking systems thinking competence with interpersonal competence:

- Communication skills with stakeholders should be developed (= interpersonal competence) using conceptual and other forms of mapping as well as systems diagrams and quantitative modeling approaches (e.g. STELLA) to represent systems and using communication approaches such as story-telling and "thick descriptions" to make systems representations accessible. What options do you have in the real system you act in (e.g. non-quantitative, artistic representations).
- An overall facility with viewing environmental challenges in the context of systems is critical, although there will be trade-offs between breadth versus depth in this competence

Select examples of methods pertaining to systems thinking competence (in bold black) Our reflections from workshop (in red)

- Qualitative system analysis
- Quantitative modeling
- Institutional, decision, governance, social system analysis
- Multi-methodologies ("thick descriptions")
- Descriptive methods
- Participatory systems approaches (e.g., participatory modeling)

Strategic thinking competence
Select examples for concepts (in bold black) Our reflections from workshop (in red)

Concepts
- Concepts of intentionality
- Transitions and transformation
    - Make decisions across cultures, space and time.
- Strategies, action programs, (systemic) interventions, and transformative governance
- Success factors, viability, feasibility, effectiveness, and efficiency
- Adaptation and mitigation
- Barriers and carriers
- Obstacles (resistance, reluctance, path dependency, habits) and synergies
    - Consider path dependency and scaling in achieving outcomes
- Instrumentalization, alliances
- Social learning
- Differentiate between tactical and strategic thinking (e.g. the field of project management split decision support from behavioral change).
- Benchmarking, piloting, implementation skills as part of process of strategic thinking

The discussion also touched on relations between strategic thinking competence with other core competencies:
- Link with values and future thinking competence by
    - considering the need for urgency as well as action (add more doing to planning)

- integrating multicultural perspectives and history by considering how changing scales can impact assumptions in forecasting (e.g. valuing life and health)

The discussion moved on from describing and defining the concepts and methods pertaining to a competency to formulating a learning objective:

- Understand how scientific method(s) can be used in strategic design
- Consider a single concept of social movements that combines the previous four concepts: barriers and carriers, obstacles and synergies, instrumentalization and alliances, social learning.

Select examples of methods pertaining to strategic thinking competence (in bold black) Our reflections from workshop (in red)

- Methods to design governance arrangements, policies, institutions
- Policy and institutional design
- Policy and program evaluation
- Program planning
- Intervention design
- Planning methodologies,
- Decision support and behavioral change methodologies
- Transition management methodology
- Methods to support learning and reflexivity
- Organizational (change) management

Use service learning as well as designing and implementing pilot projects as a way to teach strategic competency.

Interpersonal competence

Select examples for concepts (in bold black) Our reflections from workshop (in red)

Concepts
- Functions, types, and dynamics of collaboration within academia (interdisciplinarity) and beyond academia (transdisciplinarity)
- Strengths, weaknesses, success, and failure in teams
- Concepts of leadership. Must define leadership styles (especially participatory).
- Limits of cooperation and empathy
- Solidarity and ethnocentrism; combine with interculturality; working within the "commons" (as defined by Elinor Ostrom)
- Culture, inter and trans-culturality
- Emergence, cultural humility and useful ignorance: understanding how to be open to cultures, thoughts and concepts of others.
- Use of constructive conflict resolution methods (e.g., non-violent communication by Marshall Rosenberg)

- Combine intra and interpersonal e.g. emotional intelligence, coding, recognizing competencies; discernment without judgement.
- Recognize the problem of a lack of shared background in achieving competency objectives, especially if you have a hierarchical approach; how to ensure everyone masters each step. Be aware of resources you, others and institutions bring into learning.

Select examples of methods pertaining to strategic thinking competence (in bold black) Our reflections from workshop (in red)

- Participatory methods: negotiation, mediation, deliberation, constructive conflict methodology
- Teamwork methods
- Stakeholder Engagement
- Transdisciplinary research methods (co-production)

Future thinking competence

Select examples for concepts (in bold black) Our reflections from workshop (in red)

Concepts

- Consider renaming as CONTEXTUAL thinking rather than futures thinking (past, present and future)
- Concepts of time, including: temporal phases (past, present, future), terms (short, long), states, continuity (dynamics, paths), and non-linearity
- Concepts of uncertainty and epistemic status including possibility, probability, desirability of future developments (predictions, scenarios, visions)
- Concepts of inertia, path-dependency, and non-intervention
- Consistency, coherence, and plausibility of future developments
- Concepts of risk, precaution, and intergenerational equity
- Creativity, imagination, fantasy
- Recognize the role of technological changes, incorporation of history and social ecology (spatial and temporal)
- Biocultural regeneration and cultural concepts of stewardship can be critical future thinking skills.
- Assess how value-neutral predictions are.
- Improve participation and recruitment using forecasting to predict how to better engage people from diverse backgrounds (cultures and disciplines) to participate in sustainability decision-making.

Select examples of methods pertaining to futures thinking competency (in bold black) Our reflections from workshop (in red)

- Scenario methodology
- Forecasting from statistical and simulation models
- Backcasting (1st module) and envisioning methods
- Multi-methodologies
- Participatory anticipatory approaches (e.g. Delphi, Future Workshop)

Developing PLLOs and learning methods

In the last section of the workshop we reviewed proposed learning outcomes for novice, intermediate and proficient levels, compiled by Wiek et al. (2016). The review of these propose learning outcomes generated a discussion around the following points:

- There are too many PLLOs to assess.
- Many of the "learning outcomes" for the novice level (described in Wiek et al. (2016) focus more on description and knowledge and not as much on student action and activities. Action ("doing") must start at the novice level. [How could this proposal be aligned with the idea that student learning enfolds over different stages of cognitive processing as proposed by educational scholars (see the above discussion about the revised taxonomy of learning objectives)?]
- Student do not need to be told at the early stage they are "developing a competency".
- For all student activities, consider modeling an iterative (adaptive management) approach: students cycle through the same or similar case studies through higher levels of sophistication and application of learned knowledge. The degree of sophistication is based upon both complexity and efficacy. At the novice level the begin to analyze and articulate/communicate. At the intermediate level, they first learn how to design and implement. At the advanced level, they embody the competencies they have developed.
- What is the balance between content and application? The choice of pathways to achieve increasing levels of sophistication will result in different learning outcomes.
- Our tools to facilitate learning/teaching some of the competency elements should include game theory.
- Use 7th generation thinking in case studies to tie value, strategic thinking, and future thinking together. This also includes the concept of personal and professional responsibility.
- Recognize the importance of self-reflection not just as a learning tool but also as a competence.

References

Phelan, L., McBain, B., Ferguson, A., Brown, P., Brown, V., Hay, I., Horsfield, R., Taplin, R. (2015). Learning and Teaching Academic Standards Statement for Environment and Sustainability. Sydney: Office for Learning and Teaching.

Wiek, A., Withycombe, L., & Redman, C. L. (2011a). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*, *6*(2), 203–218. http://doi.org/10.1007/s11625-011-0132-6

Wiek, A., Withycombe, L., Redman, C., & Mills, S. (2011b). Moving Forward on Competence in Sustainability Research and Problem Solving. *Environment: Science and Policy for Sustainable Development*, *53*(2), 3–13. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/00139157.2011.554496

Wiek, A., Bernstein, M. J., Foley, R. W., Cohen, J. M., Forrest, N., Kuzdas, C., … Withycombe Keeler, L. (2016). Operationalising Competencies in Higher Education for Sustainable Development. In M. Barth, G. Michelsen, M. Rieckmann, & I. Thomas (Eds.), *Handbook of Higher Education for Sustainable Development* (1st ed., pp. 241–260). New York, NY: Routledge.

Wiggins, G.P.; McTighe, J. (2005). Understanding by Design. ASCD. Available online: http://www.ascd.org/ Default.aspx (accessed on 17 February 2017).