Sustainability competencies in program design and implementation

Community of Practice for Core Competencies

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Arizona State University
and National Council for Science and the Environment

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Chatham University and
National Council for Science and the Environment
Today we will cover ...

1. What are Core Competencies?
2. Why Core Competencies?
3. Core Competencies in Sustainability.
4. Current work in this area.
5. On-going challenges.
6. How you can get involved.
Core Competencies
More than Best Practice, less prescriptive than licensing
 Origins

**Business**

**Professions**
What are Competencies?

- Specific knowledge & skills and attitude
- Capacity to adapt and innovate
- Ability to use knowledge & skills
What are Core Competencies

- The “must have” skills and attributes needed to get the job done.
  - As an industry
  - As a professional
From competency to action

- **Core Competencies** lead to *measurable outcomes* via demonstrated *knowledge, skills and behavior*

<table>
<thead>
<tr>
<th>Core Competency</th>
<th>Performance</th>
<th>Measurable outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Achieving Results</td>
<td>• Ensures program quality</td>
<td>• Is accountable for own work and uses resources effectively to achieve lasting results</td>
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<tr>
<td></td>
<td>• Works accountably</td>
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<td></td>
<td>• Makes decisions</td>
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</table>
Competencies for Sustainability??

- Relational
- Analytical
- Normative
Core Competencies in Nursing

1. Orientating toward ethical/legal practice
2. Engaging in professional development
3. Collaborating with other healthcare professionals
4. Coaching of patients and staff
5. Demonstrating management skills
6. Ensuring quality and safety in care
7. Establishing interpersonal relationships with patients and nursing staff

Core Competencies in Humanitarian Aid

- Understanding context, applying standards
- Achieving results
- Developing collaborative relationships
- Operating safely and securely
- Managing stress and change
- Demonstrating leadership

https://www.chsalliance.org/what-we-do/chcf
Connecting the past to the future

Program Learning Outcomes

Core Competencies

Health effects of pollution

Air pollution
- Nerve damage
- Lead
- Particulate matter
- Ozone
- Volatile organic compounds

CO

Water pollution
- Bacteria
- Parasites
- Chemicals

Respiratory illness

Cardiovascular illness

Cancer risk

Skin irritation

Gastroenteritis

Pesticides

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Academic Competencies*: general skills, abilities and attitudes associated with learning in higher education

- *Disciplinary knowledge*
- *Scientific and quantitative reasoning*
- *Engagement in the process of discovery or creation*
- *Critical thinking*
- *Self-directed learning*
- *Communication skills*
- *Information literacy*

Core Competencies in Sustainability

“functionally linked complexes of knowledge, skills, and attitudes that enable successful task performance and problem solving with respect to real-world sustainability problems, challenges, and opportunities.”


Core competencies build off of general academic competencies
“ESD* is a learning process based on the principles that underlie sustainability and is concerned with all levels and types of learning to provide quality education and foster sustainable human development –

learning to know (a way of thinking),
learning to be (a way of being),
learning to live together (a way of co-existing),
learning to do (a way of acting)
learning to transform oneself and society.”

*education for sustainable development refers to broad educational initiatives for all students K-16. UNESCO 2011.
Goal of degrees in sustainability education is to learn to collectively address sustainability challenges (i.e. \textit{sustainability problem-solving})

UN’s Sustainable Development Goals (SDGs) is an assemblage of sustainability challenges for \textit{all society} to address
The most widely read and used framework: Wiek et al., 2011

Sustainability Problem-Solving

Sustainability knowledge bases include:
- natural sciences, social science, humanities
- SDGs responding to the grand environmental and social challenges

Competencies are developed through the study and application of this knowledge:
- not defined by the topical knowledge,
- defined by their combined contribution to a problem-solving process

Sustainability problem-solving may start by framing a sustainability issue using:
- **Systems** thinking to analyze socio-ecological systems (what, why, how)
- **Future** thinking to explore a range of future states, e.g. probable, plausible and desired (what futures are plausible, which ones are desired and by whom)
- **Values** thinking to frame the problem (for whom is this a problem, why?), who desires this future and why?
- **Strategic** thinking to explore the policies and strategies how to get things done

**Interpersonal** skills help to engage with those involved and mediate across their perspectives.
Start with Wiek et al., 2011: a result of a systematic literature review and consulting process

• Over 14,000 downloads and 457/934 citations suggests great resonance in academic community
• Used to guide academic program development in over a dozen programs
• Includes other synthesis reports, e.g., 2010 ISSP report
• Research on key competencies in sustainability is ongoing, current effort under way to update the 2011-literature review (e.g. intrapersonal competence, integration with indigenous cultures)
• **Competency Menu**
  – **Concepts** (theoretical lenses, frameworks)
  – **Methods** (to operationalize the concepts in research)
  – **Peer reviewed seminal pieces**

• Competencies are meant to be implemented **collectively**, not by one individual or activity alone
  – e.g. Systems-thinking competence is the ability to **collectively** analyze complex systems across different domains (society, environment, economy, etc.) and across different scales
  – Implies **participatory approaches** to be included in each competency menu (e.g., participatory modeling in systems thinking, consensus conferences for values thinking competence).

• To **teach** the concepts and methods in each competency, **pedagogical approaches** are necessary
Sidebar: Teaching / Learning Example

- Teaching example to contribute to systems thinking competency
  - Small Group work
  - Real-world issue: City of Asgard is confronted by recurring floods and need to update its flood risk map accounting for different flood levels
  - Learning objectives: to apply systems modeling to identify flood risk scenarios (for different strengths of floods), operationalizing the following concepts
    • Variables/indicators
    • System characteristics
    • Tipping points, resilience, adaptation
    • Values, needs, rules, structuration
  - Qualitative and quantitative methods for systems modeling: mental maps and STELLA software
  - Interpersonal methods to facilitate group work and stakeholder engagement

### Systems Thinking Competence Menu

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Methodologies</th>
<th>Peer-reviewed “Classics”</th>
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</thead>
<tbody>
<tr>
<td>Variables/indicators, subsystems, structures, functions</td>
<td>Qualitative and quantitative modeling</td>
<td>Prominent comprehensive analyses of social-ecological systems (e.g., Millennium Ecosystem Assessment report: MEA 2005; Turner et al. 2003; Ostrom 2009); socio-technical systems (Perrow 1984; Collingridge 1980; Geels 2005)</td>
</tr>
<tr>
<td>Feedback loops, complex cause-effect chains, cascading effects, inertia, tipping points, legacy, resilience, adaptation, structuration, etc.</td>
<td>Institutional, decision, governance, social systems analysis</td>
<td></td>
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<tr>
<td>Across/multiple scales: local to global</td>
<td>Multi-methodologies (“thick” description)</td>
<td></td>
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<tr>
<td>Across/multiple/coupled domains: society, environment, economy, technology, etc.</td>
<td>Participatory systems approaches (e.g., participatory modeling)</td>
<td>Prominent models (e.g., World3: Meadows et al. 1974)</td>
</tr>
<tr>
<td>People and social systems: values, preferences, needs, perceptions, (collective) actions, decisions, power, tactics, politics, laws, institutions, etc.</td>
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### Futures Thinking Competence Menu

<table>
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<tr>
<th>Concepts</th>
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<th>Peer-reviewed “classics”</th>
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</thead>
<tbody>
<tr>
<td>Concepts of time including temporal phases (past, present, future), terms (short, long), states, continuity (dynamics, paths), non-linearity</td>
<td>Scenario methodology</td>
<td>Prominent scenarios and predictions (e.g., IPCC’s <em>Special Report on Emission Scenarios</em>: Nakicenovic et al. 2000)</td>
</tr>
<tr>
<td>Concept of uncertainty and epistemic status including possibility, probability, desirability of future developments (predictions, scenarios, visions)</td>
<td>Forecasting from statistical and simulation models</td>
<td>Prominent visions and “backcasts” (e.g., “The Great Transition”: Raskin et al. 2002)</td>
</tr>
<tr>
<td>Concepts of inertia, path dependency, non-interventions</td>
<td>Backcasting and envisioning methods</td>
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<tr>
<td>Concepts of consistency and plausibility of future developments</td>
<td>Multi-methodologies</td>
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<tr>
<td>Concepts of risk, intergenerational equity, precaution</td>
<td>Participatory anticipatory approaches (e.g., Delphi, Future Workshop)</td>
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### Normative Thinking Competence Menu

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Methodologies</th>
<th>Peer-reviewed “classics”</th>
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</thead>
<tbody>
<tr>
<td>(Un-)sustainability of current or future states</td>
<td>Multi-criteria assessment methods (normative component of assessment methods, including Life-Cycle Assessment, Multi-Attribute Utility Theory, etc.)</td>
<td>Prominent (value-laden) tipping points of socio-ecological systems (cf. Rockström et al. 2009)</td>
</tr>
<tr>
<td>Sustainability principles, goals, targets, thresholds (tipping points)</td>
<td>Risk analysis</td>
<td>Prominent sets of sustainability principles (cf. Brundtland report: WCED 1987; Gibson, 2006)</td>
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<tr>
<td>Concepts of justice, fairness, responsibility, safety, happiness, etc.</td>
<td>Sustainability efficiency analysis</td>
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<tr>
<td>Concept of risk, harm, damage</td>
<td>Envisioning methods(^3) (e.g., backcasting)</td>
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<tr>
<td>Concept of reinforcing gains (“win–win”) and tradeoffs</td>
<td>Participatory methods (e.g. negotiation methods, consensus conference)</td>
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<td>Ethical concepts</td>
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\(^3\) Envisioning methods refer to techniques such as backcasting for scenario planning and future forecasting.

### Strategic Thinking Competence Menu

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<tbody>
<tr>
<td>Intentionality</td>
<td>Methods to design governance arrangements, policies, institutions</td>
<td>Prominent transition strategies (e.g., Lester Brown’s “Plan B 3.0”: Brown 2008)</td>
</tr>
<tr>
<td>Transitions and transformation</td>
<td>Planning methodologies</td>
<td>Prominent transformations (e.g., socio-technical transitions in The Netherlands: Loorbach 2007)</td>
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<tr>
<td>Strategies, action programs, (systemic)</td>
<td>Decision support methodologies</td>
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<td>intervention, transformative governance</td>
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<tr>
<td>Success factors, viability, feasibility,</td>
<td>Transition management methodology</td>
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<tr>
<td>effectiveness, efficiency</td>
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<tr>
<td>Adaptation and mitigation</td>
<td>Methods to support learning and reflexivity</td>
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<tr>
<td>Obstacles (resistance, reluctance, path</td>
<td>Organizational (change) management</td>
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<tr>
<td>dependency, habits) and synergies</td>
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<tr>
<td>Instrumentalization and alliances</td>
<td>Methods to support behavioral change</td>
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<td>Social learning</td>
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<td>Social movements</td>
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### Interpersonal Competence Menu*

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</thead>
<tbody>
<tr>
<td>Functions, types, and dynamics of collaboration (within and beyond academia; interdisciplinarity, transdisciplinarity)</td>
<td>Participatory methods, including negotiation, mediation, deliberation, constructive conflict methodology</td>
<td>Prominent sets of participatory approaches (e.g., Rowe and Frewer 2005)</td>
</tr>
<tr>
<td>Strengths, weaknesses, success, and failure in teams</td>
<td>Teamwork methods</td>
<td>Prominent collaborative settings (e.g. Model United Nations: McIntosh 2001)</td>
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<tr>
<td>Concepts of leadership</td>
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<td>Limits of cooperation and empathy</td>
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<tr>
<td>Concepts of solidarity and ethnocentrism</td>
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*developing skills in effective communication, collaboration, cooperation

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Mapping competencies onto a framework

Sustainability Problem—Solving Capacity

Progressing through the sustainability problem-solving framework with increasing levels of competence

Transition Arena

**LEARNING PHASE A**
- Problem framing
- Team building

**LEARNING PHASE B**
- Co-creation of solution-oriented Competencies

**LEARNING PHASE C**
- Integration, Application and Reflection of Competencies

transdisciplinary learning processes (adapted from Lang et al., 2012)
LEARNING AND TEACHING FOR ENVIRONMENT AND SUSTAINABILITY

What knowledge, understanding and skills do graduates from higher education need in the Environment and Sustainability field?

We developed learning standards by asking stakeholders throughout Australia and around the world...

7 workshops nationally (Perth, Sydney, Melbourne, Canberra, Gold Coast, Newcastle, Adelaide)
850 invitations to participate in an online questionnaire and online discussions
1000 Communication with over 1000 stakeholders
250 Over 250 individuals actively collaborated in the development of the standards by providing over 2500 separate pieces of advice and guidance
3 Standards piloted at 3 universities

Standards grouped into:
- Transdisciplinary knowledge
- Systemic understanding
- Skills for environment and sustainability
- Ethical practice

Standards for:
- Bachelor degrees
- Bachelor honours degrees
- Graduate Certificates
- Graduate Diplomas
- Masters (coursework) degrees

The standards 'are clear and comprehensive. Their purpose, significance and justification are well articulated...the invitational tone, accessible language and clear articulation of concepts and concerns is to be celebrated'.

'ACEDD endorses the Statement as a guide for tertiary teaching in Environment and Sustainability. The Project Team is to be commended.'

For further information, visit: environmentLTAS.gradschool.edu.au

This was a 12-month project, commissioned by the Australian Council of Environmental Deans and Directors. This project was a collaboration of the University of Newcastle (lead institution), Australian National University, Flinders University, Macquarie University and University of New South Wales. Support for this project was provided by the Australian Government Office for Learning and Teaching.

PROJECT TEAM: Dr Bonnie McBeain, Dr Liam Phelan & Ms Anna Ferguson (Newcastle), Emeritus Professor Valerie Brown AO (ANU), Matthew Flinders Distinguished Professor Iain Hay (Flinders), Mr Richard Horfield (Macquarie), Honorary Associate Professor Paul Brown & Professor Ros Taplin (UNSW).

PROFESSOR DANIELLA TILBURY, EXTERNAL EVALUATOR, CHELTENHAM, UK

PROFESSOR ANDREW MILLINGTON, PRESIDENT, AUSTRALIAN COUNCIL OF ENVIRONMENTAL DEANS AND DIRECTORS

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<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>THRESHOLD LEARNING OUTCOME</th>
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</table>
| Transdisciplinary knowledge    | **1. Demonstrate a broad and coherent knowledge of:**  
|                                | 1.1. environments at various scales, interdependencies between human societies and environments, and sustainability  
|                                | 1.2. key environmental and sustainability challenges and their drivers  
|                                | 1.3. holistic systems thinking and complexity.                                                                                                                                 |
| Systemic understanding         | **2. Demonstrate an understanding of diverse approaches to environment and sustainability, including:**  
|                                | 2.1. disciplinary and transdisciplinary approaches to identifying and conceptualising environmental and sustainability challenges  
|                                | 2.2. different frameworks for knowing  
|                                | 2.3. their own and others’ values, knowledge, ethical positions and interests  
|                                | 2.4. the particular values, knowledge, ethical positions and interests of indigenous peoples globally.                                                                                                                                 |
| Skills for environment and sustainability | **3. Demonstrate well-developed cognitive, technical and communication skills through:**  
|                                | 3.1. addressing research questions by identifying, synthesising and applying appropriate knowledge and evidence from diverse sources  
|                                | 3.2. thinking critically and creatively in designing and evaluating sustainable alternatives and envisioning sustainable futures  
|                                | 3.3. applying tools, methods, skills and theoretical knowledge for environment and sustainability practice  
|                                | 3.4. working both independently and collaboratively  
|                                | 3.5. communicating with diverse groups in various contexts using a range of written, oral and visual means  
|                                | 3.6. engaging with Indigenous approaches to environmental and sustainability challenges.                                                                                                                                 |
| Ethical practice               | **4. Demonstrate an ethical professional, public and personal conduct by having capacity to:**  
|                                | 4.1. reflect on and direct their own learning and practice in the context of environment and sustainability  
|                                | 4.2. participate constructively in decision-making consistent with principles of sustainable development.                                                                                                                                 |
Pedagogy can address the noise in helping students understand and attain sustainability competence.

“where terms are drawn from... established usage in the educational literature and applied for specific purposes in education for sustainable development, they need to be clearly defined with respect to their educational context”


define competencies through the activities used to master them
Pedagogy can help students understand and attain sustainability competence

- understand students’ perceptions as well as definition of competencies
- how they are conveyed in the classroom
- clarity of definition and description
- how they are received in the classroom

need transparency in the use and understanding of competencies as educational objectives
the NCSE core competencies consensus statement

through a survey of dozens of experts and in-person workshops at meetings including AASHE, SCC, and NCSE gather a wide range of informed, expert opinions.

produce a consensus statement on key competencies at the program-level. Consider programs as a whole, not individual course curricula.

not prescriptive, but a guide for new and evolving programs, students, administrators and employers

broad perspective providing holistic approach to socio-environmental and sustainability problem-solving
Organization and timeline

**National Academy of Sciences (NAS)**

- Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels (Link)

**National Council for Science and the Environment (NCSE)**

- Developing Consensus Around Program Level Learning Outcomes around Key Competencies in Sustainability

**Delphi Research Study**

- Expert-based structured research project
- Community of Practice
  - Role: ...
- Community Engagement
  - Meeting-based interactive presentations and discussions

**Educating Future Change Agents (EFCA)**

- Educating Future Change Agents Research Program
- ASU and Leuphana University

Consensus Statement for NCSE endorsement

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Why have ethics?

Problem

Do nothing

Solve Problem

Desired end state

Other end state
Values and wicked issues in sustainability: the desire or need for change agents

Acting for positive change and contributing to co-creating a better future

“Sustainability depends on change agents who have the skills, persistence, and resilience to contribute to the emergence of healthy ecosystems, social systems, and economies. Change requires students engage others and implement or contribute to positive change”  Marcus et al., 2015
What are Ethics?

- **Ethics** refer to rules provided by an external source, e.g., codes of conduct in workplaces or principles in religions.

- **Morals** refer to an individual's own principles regarding right and wrong.
Definition:

• Students do not plagiarize work

Indicators:

• % term end essays with plagiarized text

Measurement:

• *Turn it in* applied to all essays
Where are we going?
How are we going to get there?
Unsustainably or sustainably?
an entirely homogeneous group of novice, white boys?

Successful navigation includes integration, collaboration and participation of diverse communities looking downstream at various scales capacity building and outreach
Phase II: On-going discussions

What are critical learning activities that relate to core competencies?

Education about / of / for sustainability / sustainable development?
  - Education for sustainable development = outcome orientation
  - Pedagogical approach: Emancipatory vs. prescriptive

Sustainability literacy vs. sustainability change agents (academic / professional)
  - The degree to which sustainability programs train sustainability professionals
  - Focusing on careers related to e.g., ISSP or Association of Climate Adaptation
  - Professionals versus a broader set of overarching competencies for a wide range of career options.

Scaling of efforts: extend beyond our own programs? “modules” for other programs (health professions, business, education etc.)?

Outreach to communities, cultures, populations currently not participating
Join or follow the Community of Practice for Core Competencies
Kate Ceste kceste@ncseglobal.org
Participate in workshops at the CEDD/NCSE member meeting
Fayetteville, AR, June 24-26
Participate in workshops at the CEDD/NCSE member meeting
Washington, DC January 6-9, 2020
Nominate/Self-Nominate participants for workforce on diversity in sustainability

And/or contact
Rod Parnell, Senior Fellow NCSE and Co-Chair CoP Rod.Parnell@nau.edu
Peter Walker, Chair, Council of Environmental Deans and Directors, Board member NCSE, and Co-Chair CoP Pwalker@Chatham.edu
Katja Brundiers, Co-Chair CoP, Katja.Brundiers@asu.edu
references
InTeGrate as part of the SERC Library: https://serc.carleton.edu/index.html
https://doi.org/10.1080/13504622.2010.505445


https://www.aacu.org/leap/national-leadership-council


