National Council for Science and the Environment

Sustainability competencies in program design and implementation

Community of Practice for Core Competencies

Presenters and Co-chairs

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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
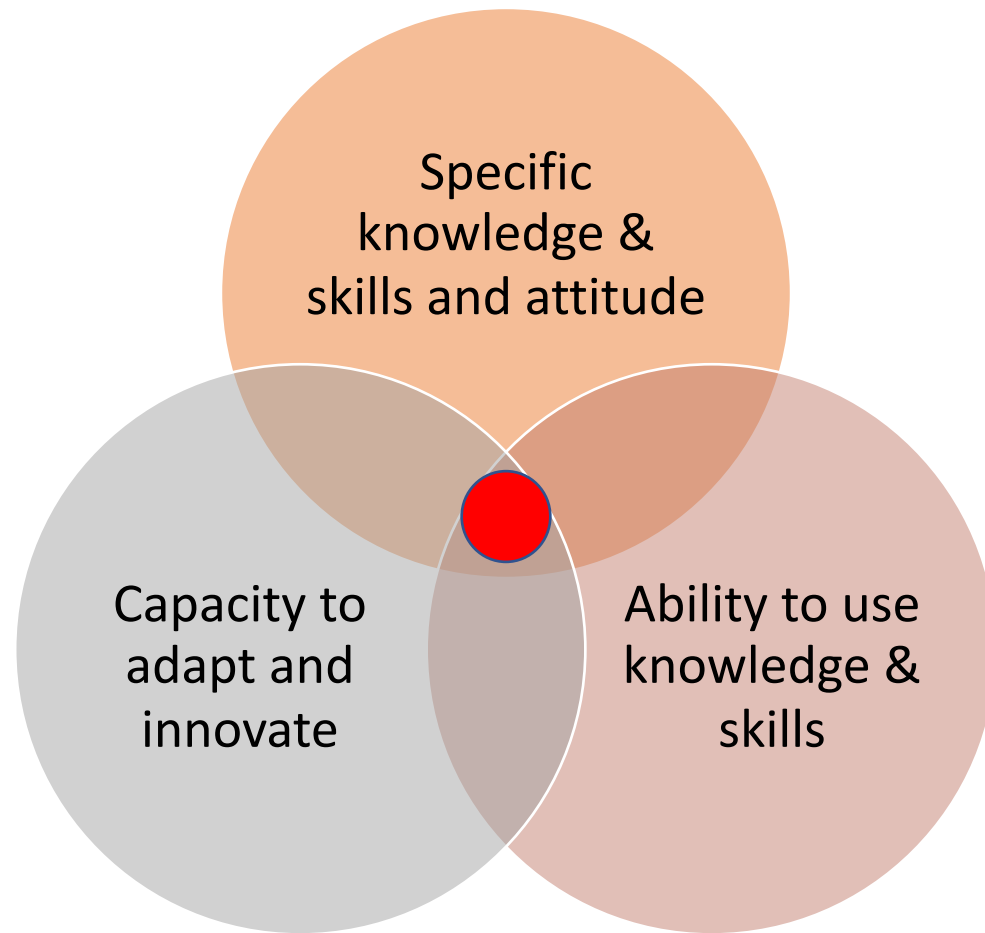## More than Best Practice, less prescriptive than licensing
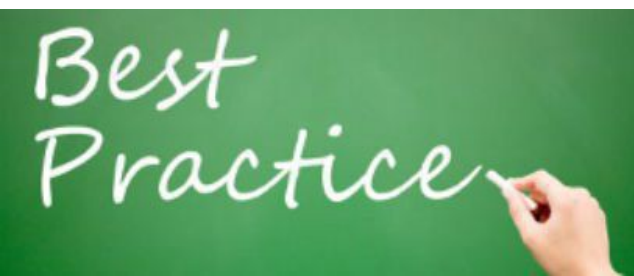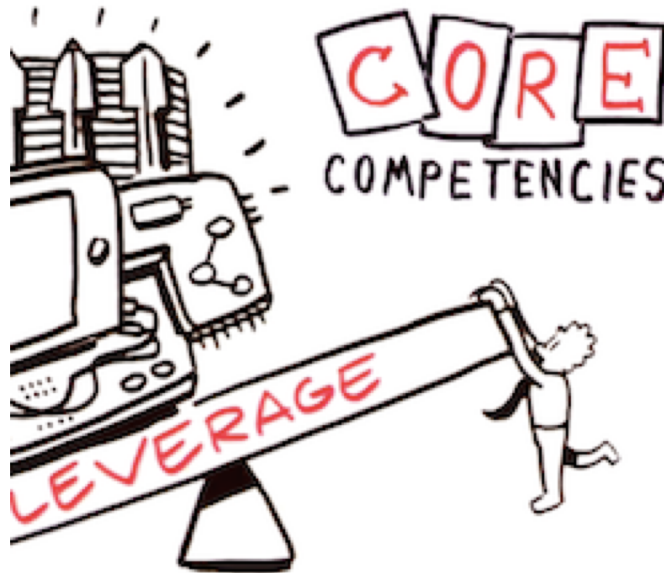
Origins

Business

Professions

What are Competencies?

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**

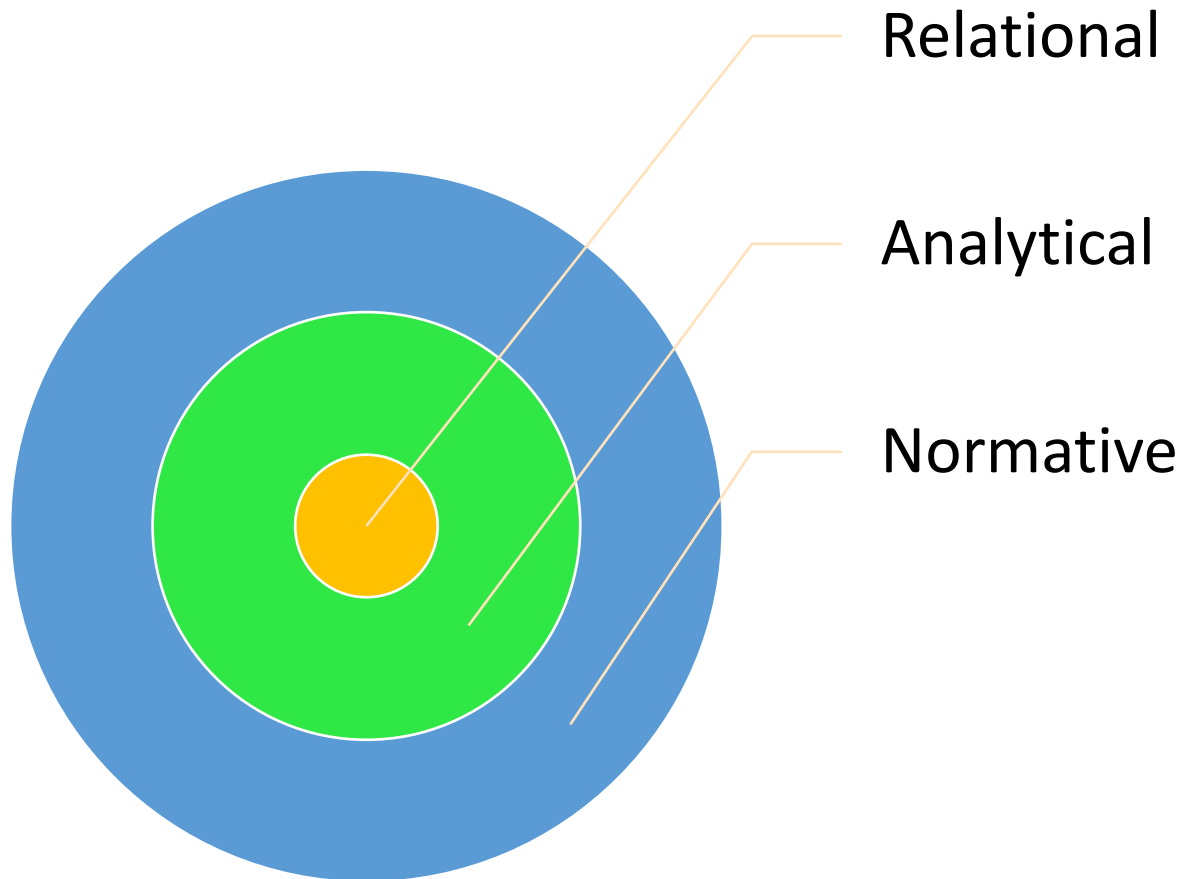| Core Competency	Performance	Measurable outcome
• Achieving Results	• Ensures program quality • Works accountably • Makes decisions	• Is accountable for own work and uses resources effectively to achieve lasting results

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
8. Managing nursing care.

Development of the Holistic Nursing Competence Scale.*Takase M, Teraoka S Nurs Health Sci. 2011 Dec; 13(4):396-403.*
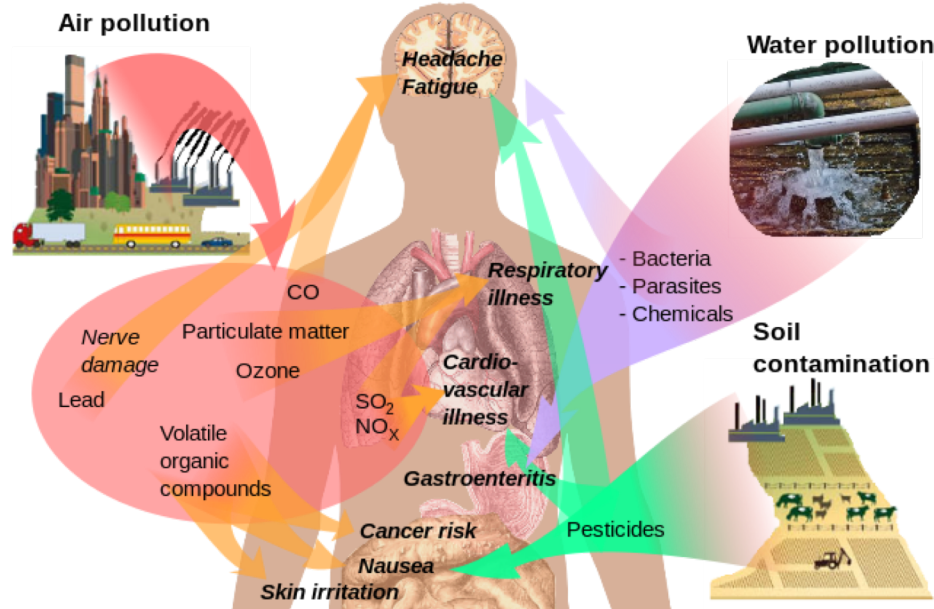
Core Competencies in Humanitarian Aid

- 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

Water pollution

Headache
Fatigue

- Bacteria
- Parasites
- Chemicals

Respiratory illness

Soil contamination

CO

Particulate matter

Nerve damage

Ozone

Cardio-vascular illness

Lead

SO_2
NO_x

Volatile organic compounds

Gastroenteritis

Cancer risk

Pesticides

Nausea

Skin irritation

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*

* Engle, Elyzabeth W., Susannah H. Barsom, Lydia Vandenbergh, Glenn E. Sterner III, and Theodore R. Alter. "Developing a framework for sustainability meta- competencies." *International Journal of Higher Education and Sustainability* 1, no. 4 (2017): 285-303

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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."

Wiek, A., Withycombe-Keeler, L., & C.L. Redman, 2011: 204.

Core competencies build off of general academic competencies

Framework for education for sustainable development

"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. ***sustainability problem-solving***)

UN's Sustainable Development Goals (SDGs) is an assemblage of sustainability challenges for *all society* to address

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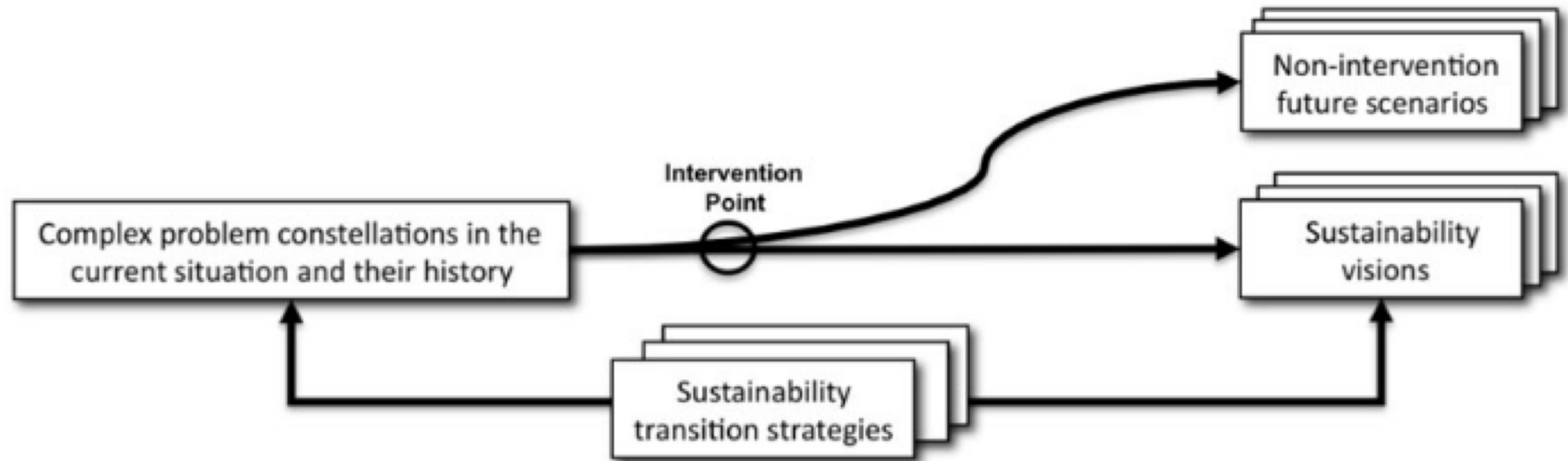
Source: Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*, 6(2), 203–218. http://doi.org/10.1007/s11625-011-0132-6

sustainability core competencies vs knowledge bases

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
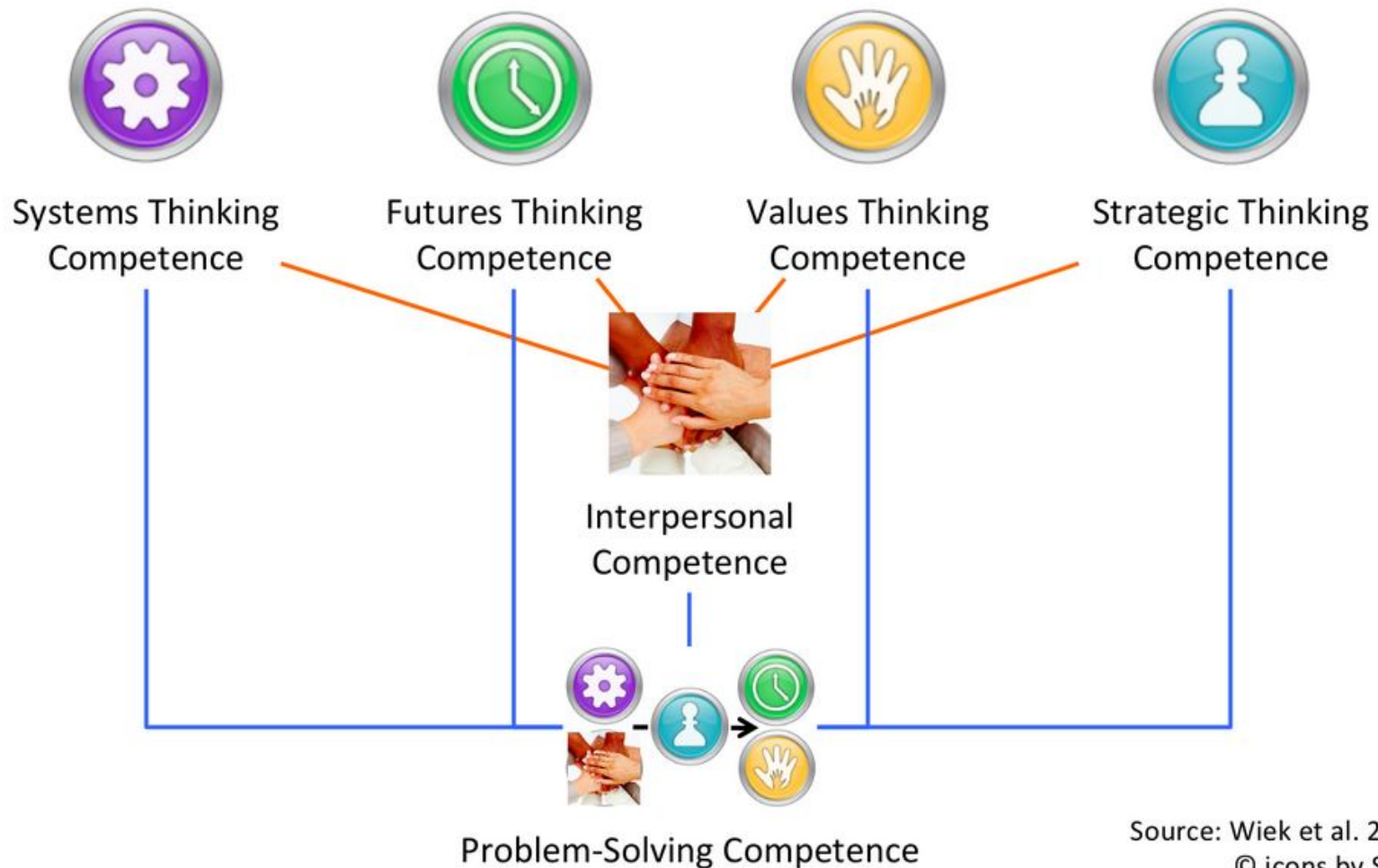> *Interpersonal* skills help to engage with those involved and mediate across their perspectives

"Key competencies in sustainability: a reference framework for academic program development"

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)

6 Core Competencies in Sustainability

Systems Thinking Competence

Futures Thinking Competence

Values Thinking Competence

Strategic Thinking Competence

Interpersonal Competence

Problem-Solving Competence

Source: Wiek et al. 2011
© icons by SSFT

Preface: Core Competencies in Sustainability

- **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 it 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
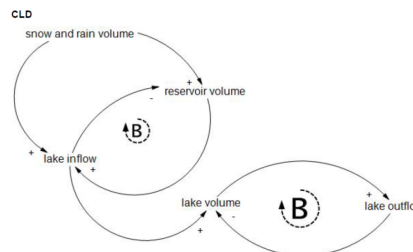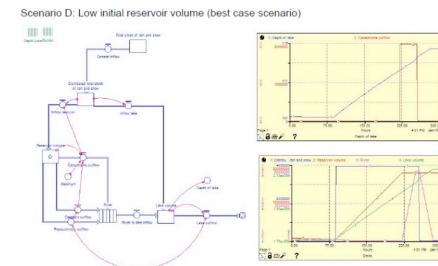 - Interpersonal methods to facilitate group work and stakeholder engagement

CLD

Fig. A1: Causal Loop Diagram of water flows.

Scenario D: Low initial reservoir volume (best case scenario)

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Systems Thinking Competence Menu

Concepts	Methodologies	Peer-reviewed "Classics"
Variables/indicators, sub-systems, structures, functions	Qualitative and quantitative modeling	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)
Feedback loops, complex cause-effect chains, cascading effects, inertia, tipping points, legacy, resilience, adaptation, structuration, etc.	Institutional, decision, governance, social systems analysis	
	Multi-methodologies ("thick" description)	
Across/multiple scales: local to global	Participatory systems approaches (e.g., participatory modeling)	Prominent models (e.g., World3: Meadows et al. 1974)
Across/multiple/coupled domains: society, environment, economy, technology, etc.		
People and social systems: values, preferences, needs, perceptions, (collective) actions, decisions, power, tactics, politics, laws, institutions, etc.		

The National Council for

Concepts	Methodologies	Peer-reviewed "classics"
Concepts of time including temporal phases (past, present, future), terms (short, long), states, continuity (dynamics, paths), non-linearity	Scenario methodology	Prominent scenarios and predictions (e.g., IPCC's *Special Report on Emission Scenarios*: Nakicenovic et al. 2000)
	Forecasting from statistical and simulation models	
Concept of uncertainty and epistemic status including possibility, probability, desirability of future developments (predictions, scenarios, visions)	Backcasting and envisioning methods	Prominent visions and "backcasts" (e.g., "The Great Transition": Raskin et al. 2002)
	Multi-methodologies	
	Participatory anticipatory approaches (e.g., Delphi, Future Workshop)	
Concepts of inertia, path dependency, non-interventions		
Concepts of consistency and plausibility of future developments		
Concepts of risk, intergenerational equity, precaution		

Normative Thinking Competence Menu

Concepts	Methodologies	Peer-reviewed "classics"
(Un-)sustainability of current or future states	Multi-criteria assessment methods (normative component of assessment methods, including Life-Cycle Assessment, Multi-Attribute Utility Theory, etc.)	Prominent (value-laden) tipping points of social-ecological systems (cf. Rockström et al. 2009)
Sustainability principles, goals, targets, thresholds (tipping points)		Prominent sets of sustainability principles (cf. Brundtland report: WCED 1987; Gibson, 2006).
Concepts of justice, fairness, responsibility, safety, happiness, etc.	Risk analysis	
	Sustainability efficiency analysis	
Concept of risk, harm, damage	Envisioning methods[3] (e.g., backcasting)	
Concept of reinforcing gains ("win–win") and tradeoffs	Participatory methods (e.g. negotiation methods, consensus conference)	
Ethical concepts		

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Strategic Thinking Competence Menu

Concepts	Methodologies	Peer-reviewed "classics"
Intentionality	Methods to design governance arrangements, policies, institutions	Prominent transition strategies (e.g., Lester Brown's "Plan B 3.0": Brown 2008)
Transitions and transformation		
Strategies, action programs, (systemic) intervention, transformative governance	Planning methodologies	Prominent transformations (e.g., socio-technical transitions in The Netherlands: Loorbach 2007)
	Decision support methodologies	
Success factors, viability, feasibility, effectiveness, efficiency	Transition management methodology	
Adaptation and mitigation	Methods to support learning and reflexivity	
Obstacles (resistance, reluctance, path dependency, habits) and synergies	Organizational (change) management	
Instrumentalization and alliances	Methods to support behavioral change	
Social learning		
Social movements		

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Interpersonal Competence Menu*

Concepts	Methodologies	Peer-reviewed "classics"
Functions, types, and dynamics of collaboration (within and beyond academia; interdisciplinarity, transdisciplinarity)	Participatory methods, including negotiation, mediation, deliberation, constructive conflict methodology	Prominent sets of participatory approaches (e.g., Rowe and Frewer 2005)
Strengths, weaknesses, success, and failure in teams	Teamwork methods	Prominent collaborative settings (e.g. Model United Nations: McIntosh 2001)
Concepts of leadership		
Limits of cooperation and empathy		
Concepts of solidarity and ethnocentrism		

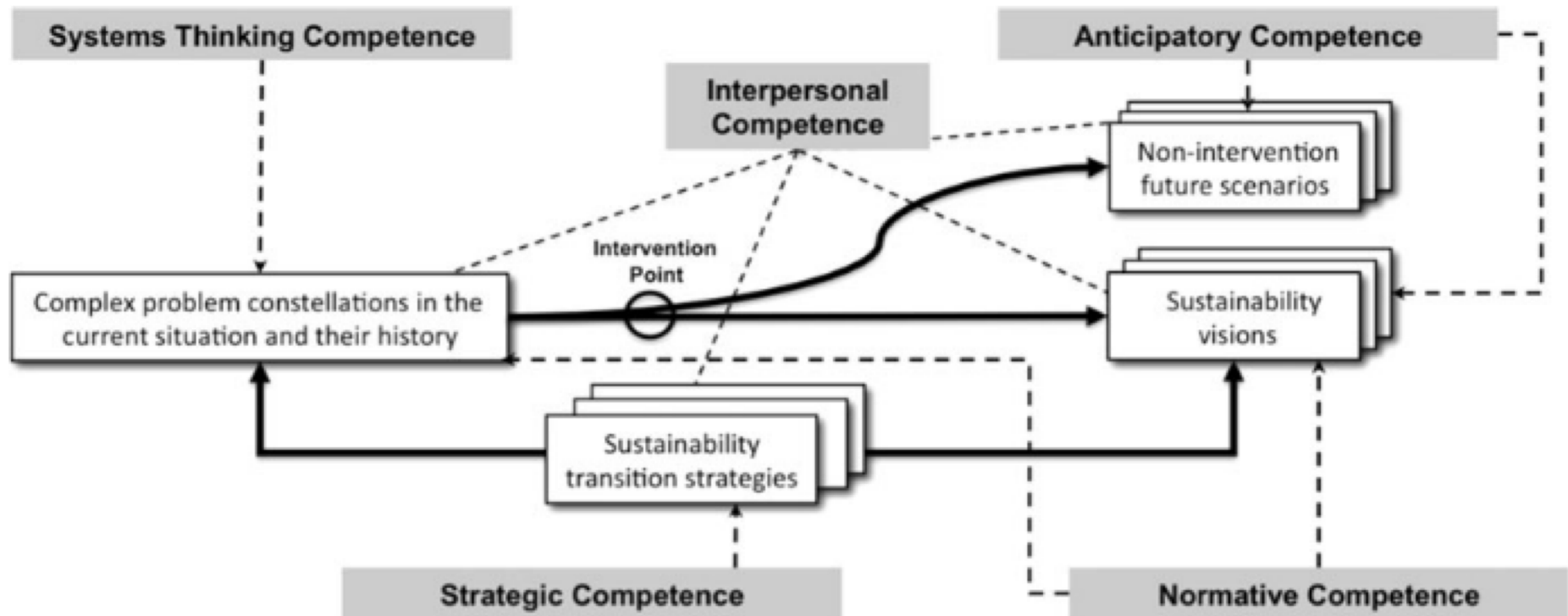*developing skills in effective communication, collaboration, cooperation

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Sustainability Problem—Solving Capacity

Source: Wiek, A., Withycombe, L., & Redman, C. L. (2011). 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
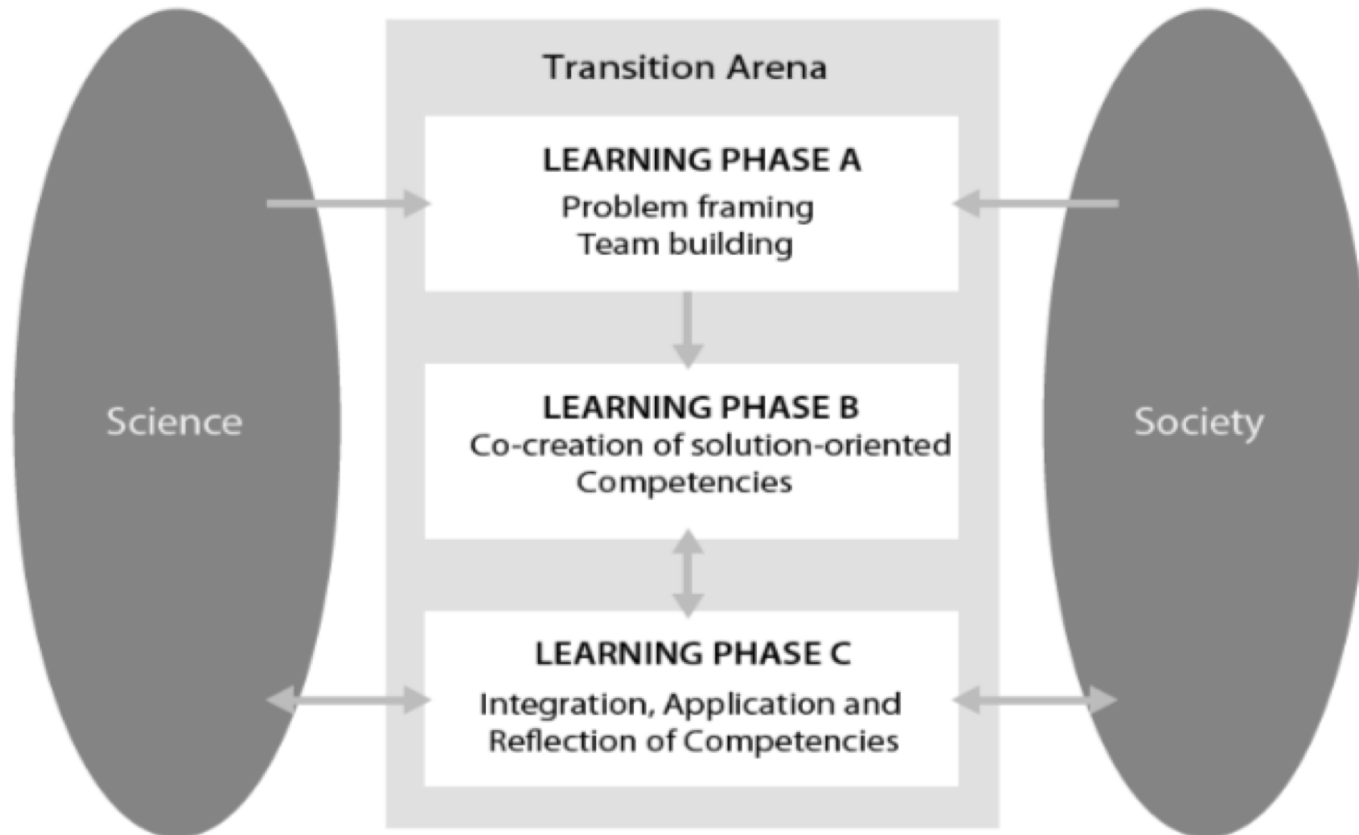
Progressing through the sustainability problem-solving framework with increasing levels of competence

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 . . .

Australian Government | Office for **Learning & Teaching**

7

7 workshops nationally (Perth, Sydney, Melbourne, Canberra, Gold Coast, Newcastle, Adelaide)

850

850 invitations to participate in an online questionnaire and online discussions

1000

Communication with over 1000 stakeholders

2500

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'.

PROFESSOR DANIELLA TILBURY, EXTERNAL EVALUATOR, CHELTENHAM, UK

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

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

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

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

THE UNIVERSITY OF NEWCASTLE AUSTRALIA | ANU THE AUSTRALIAN NATIONAL UNIVERSITY | Flinders UNIVERSITY | MACQUARIE UNIVERSITY | UNSW AUSTRALIA | AUSTRALIAN COUNCIL OF ENVIRONMENTAL DEANS AND DIRECTORS

Case study from Australia

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DOMAIN	THRESHOLD LEARNING OUTCOME

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*"

–Shephard, K., Rieckmann M., & Barth, M. (2018)

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

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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

2018 → 2019 → 2020 →

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Why have ethics?

Problem

Do nothing

Solve Problem

Desired end state

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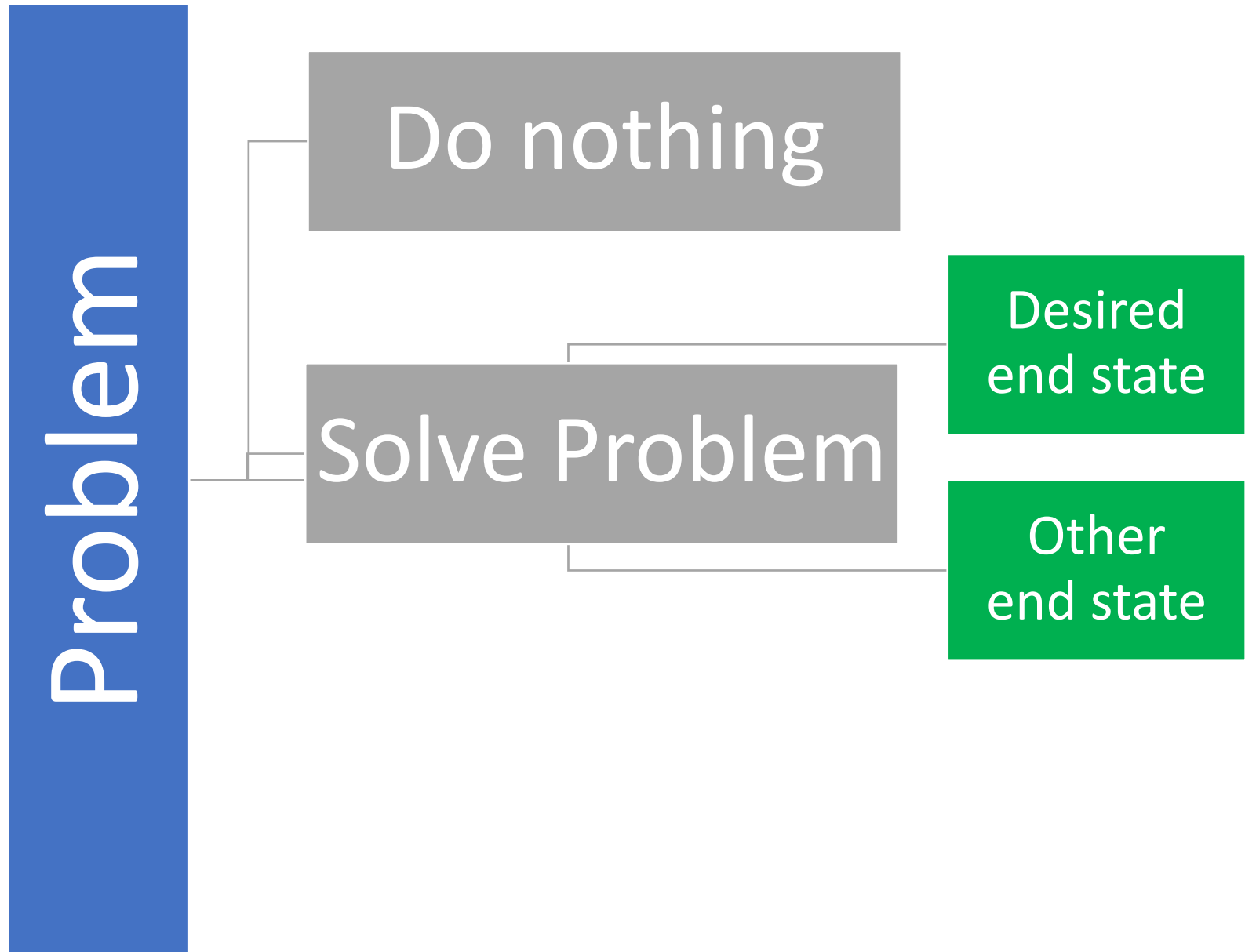
Values and wicked issues in sustainability: the desire or need for change agents

Acting for <mark>positive</mark> change and contributing to co-creating a <mark>better</mark> future

"Sustainability depends on change agents who have the skills, persistence, and resilience to contribute to the emergence of <mark>healthy</mark> ecosystems, social systems, and economies. Change requires students engage others and implement or contribute to <mark>positive</mark> 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?

Vector Illustrations

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

Get involved

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

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