Sustainability competencies in 21st century higher education

Strengthening Sustainability Programs
And Curricula at the Undergraduate
And Graduate Levels
NAS
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Focusing on program level core competencies (Program-Level Learning Outcomes) addresses

how our sustainability programs and their PLLOs relate to larger frameworks:

- institutional frameworks: general education and the 21st century student
- sustainability frameworks like SDGs

our roles as sustainability educators

how we differentiate our graduates from those of other 21st century, interdisciplinary programs

Working through the layers, general to specific

1) Education in the 21st century
   general competencies and frameworks
2) STEM higher education framework
3) Education for sustainable development/sustainability
   core competencies
   core competencies in sustainability
4) Pedagogies and learning activities in sustainability
   teaching and learning environments
   educator and student
      transparency of competencies and learning outcomes
   normative competencies and the challenges of assessment
   developing change agents working professionals and scholars
5) Ongoing activities

Discussion and questions

Education in the 21st century K-16

A transformative learning environment

- Focus on self-organization: shape and organize their own working and learning environment, define "how to play"
- Peer-to-peer learning: students share knowledge and expertise; work together on various projects
- Collaboration with different stakeholder groups of the region
- Open house rule of a learning and development space – communication and mutual social learning

Krasny et al., 2010

Competences, within a framework

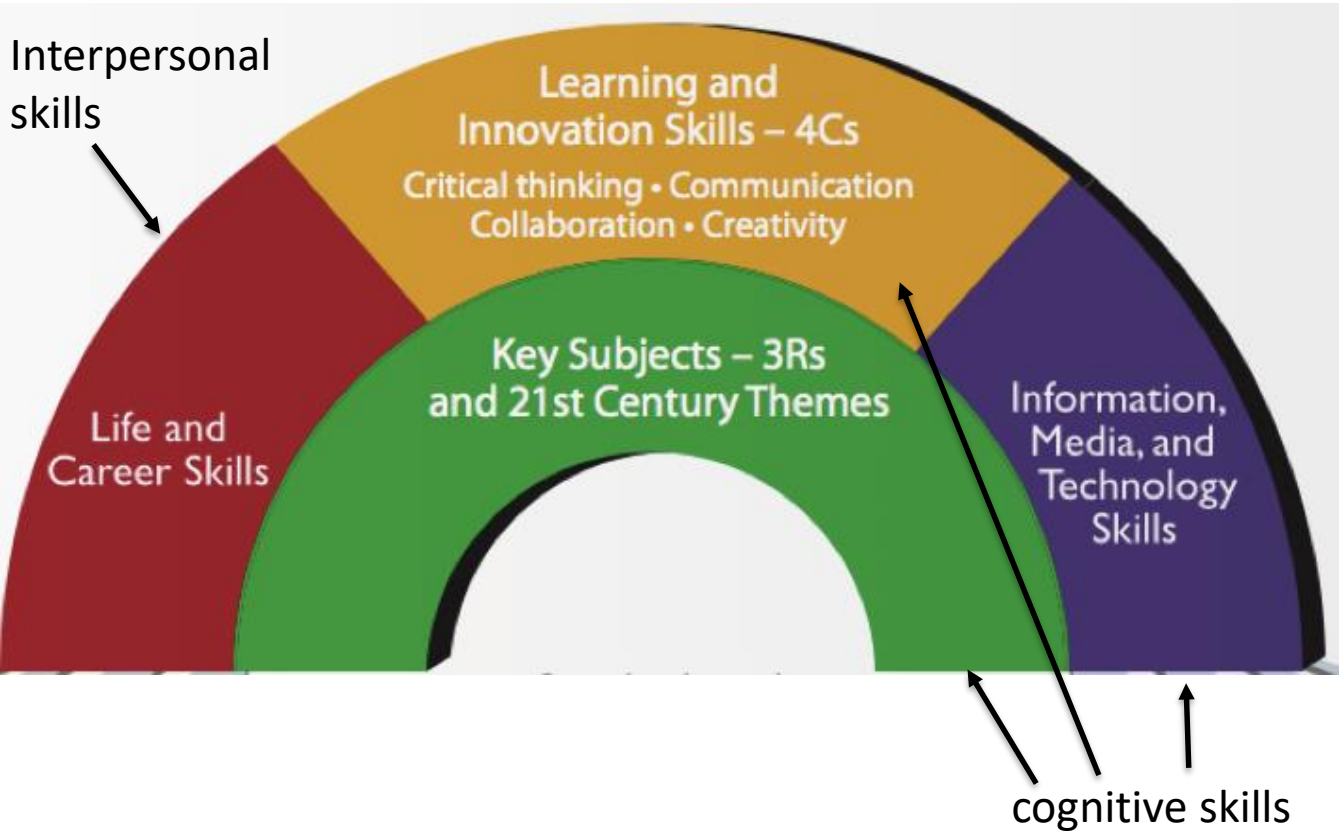
- **a cluster of specific abilities** (a number of related abilities per competency)
- "**ability to use knowledge** – encompassing
  - information, understanding, skills, values, and attitudes
  - in specific contexts and to meet demands."
- **students' "capability to adapt and to respond"** to "changes in the world today, [which are] characterized by new levels of complexity and contradiction."

UNESCO 2015

core competencies

- **Core or key** competencies "can be described as a **set of sub-competencies** from distinctive competence classes such as"
  - personal, professional-methodological, social-communicative and action competencies (c.f., Erpenbeck & Heyse 1999)
  - UNESCO four pillar approach 'Learning, the treasure within' (Delors 1998)
    - **Learning to know, do, be, live together**

P21 or C21 general framework



skills for the current workforce

problem-based learning
co-operative learning
experiential learning
special focus on information & communication technologies (ICT)

assessment driven

all levels of learning

Knowledge of Human Cultures and the Physical and Natural World

Sciences, mathematics, social sciences, humanities, histories, languages, arts

Focused by engagement with big questions, both contemporary and enduring

Intellectual and Practical Skills:

- Inquiry and analysis
- Quantitative literacy
- Information literacy
- Teamwork and problem solving

primarily cognitive competencies

Practiced extensively, through progressively more challenging problems, projects

Personal and Social Responsibility:

- Civic knowledge and engagement—local and global
- Intercultural knowledge and competence
- Ethical reasoning and action

Anchored through active involvement with diverse communities and real-world challenges

Integrative and Applied Learning:

- Synthesis across general and specialized studies

Demonstrated by the application of knowledge, skills, and responsibilities to new settings

Cognitive competencies

- knowledge
- processes & strategies
  - (critical thinking, analysis, problem-solving)
- creativity

Interpersonal competencies

- leadership
- collaboration, communication, teamwork

Intrapersonal competencies

- intellectual openness (adaptability, cultural awareness, curiosity responsibility)
- work ethic/conscientiousness
- self-regulation, stability

Comparing general frameworks

Table 4. Similarities and differences between frameworks.

Mentioned in *all* frameworks	Mentioned in *most* frameworks (i.e. P21, EnGauge, ATCS, and NETS/ISTE)
• Collaboration • Communication • ICT literacy • Social and/or cultural skills, citizenship	• Creativity • Critical thinking • Problem-solving • Develop quality products/ Productivity (except in ATCS)

overall focus on cognitive and academic skills
but also recognize some interpersonal competence

Voogt & Pareja Roblin, 2012

STEM education framework K-16 NAS, 2018

Conceptual Framework	Objective	Indicator
Goal 1: Increase Students' Mastery of STEM Concepts and Skills by Engaging Them in Evidence-Based STEM Educational Practices and Programs		
Process	1.1 Use of evidence-based STEM educational practices both in and outside of classrooms	1.1.1 Use of evidence-based STEM educational practices in course development and delivery 1.1.2 Use of evidence-based STEM educational practices outside the classroom

no mention of interdisciplinarity, community engagement or engagement in sustainability challenges,
but indicates that service or community-based learning is a "high-impact practice"

Transformational pedagogy typically includes

- action-oriented, inquiry-based learning
- systems-based learning
- integrated, holistic approaches
- creative use of technology

The 21st century education agenda lacks

- attention to the sustainability context of social and environmental challenges
- acknowledgement of the existence of planetary limits to old style economic growth

Lozano et al., 2017

Framework for education in sustainable development

UNESCO, 2011

"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)**,**

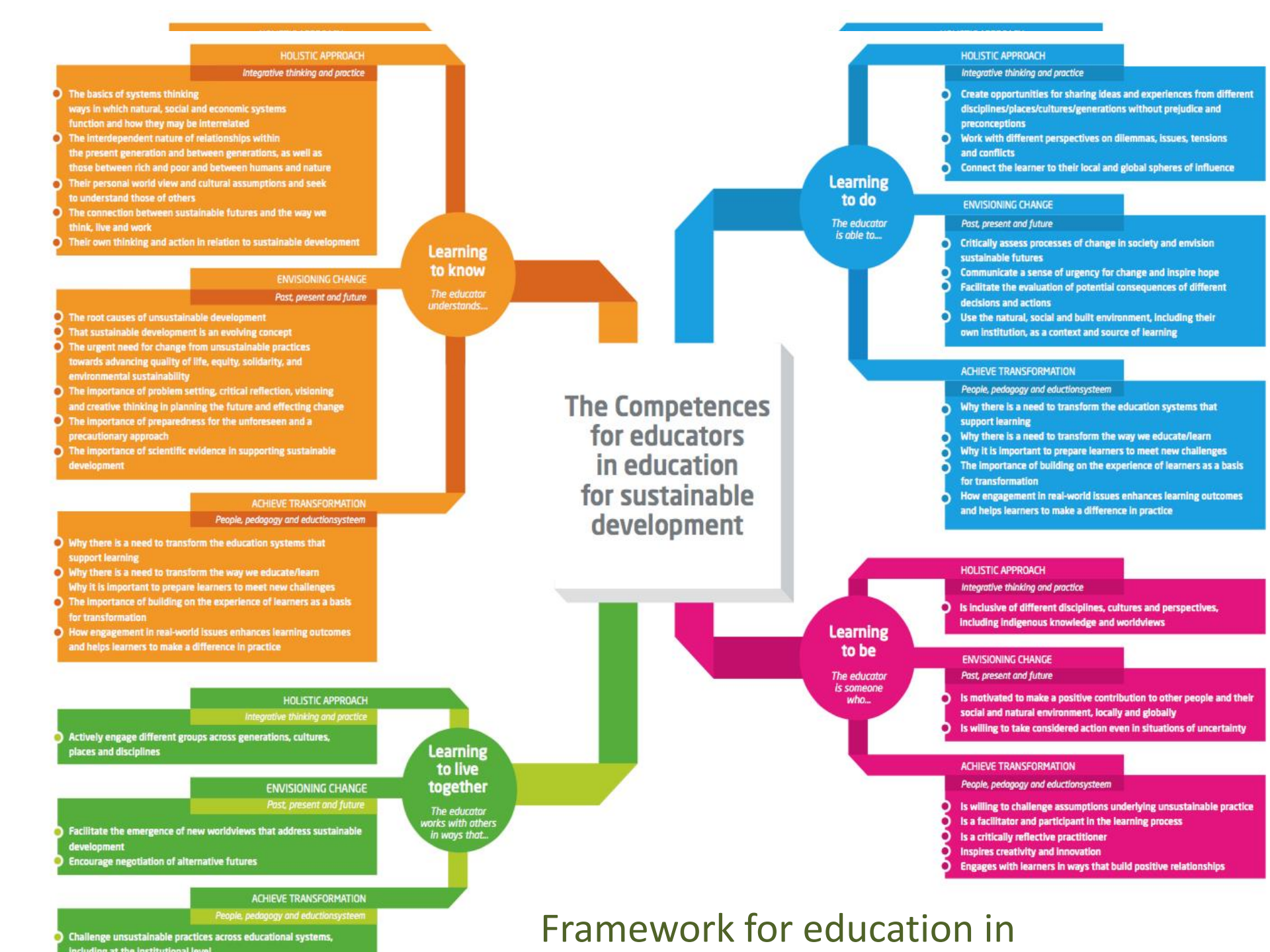
learning to be (a way of being),

learning to live together (a way of co-existing),

learning to do (a way of acting)

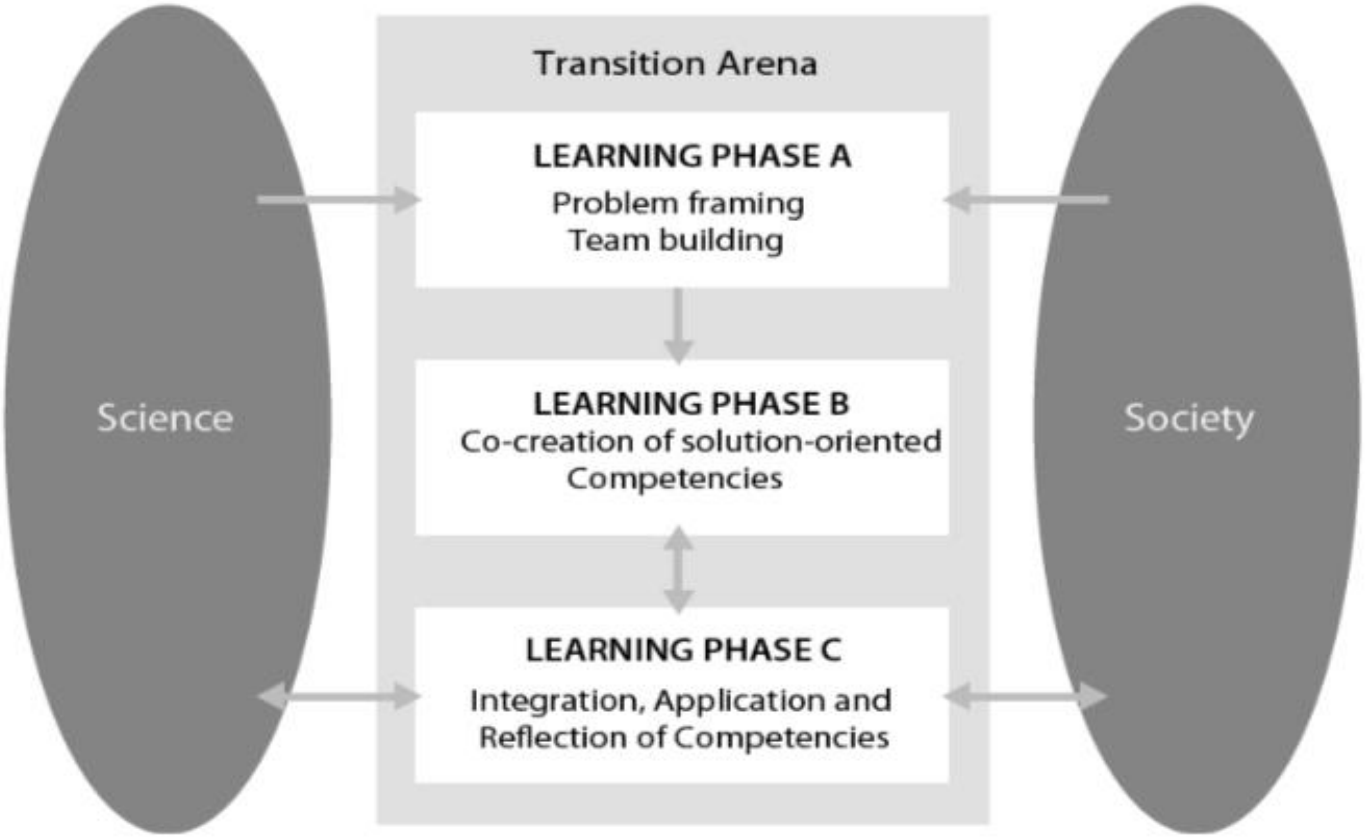
learning to transform oneself and society."

*education for sustainable development is a preferred international term, for our purposes synonymous with sustainability education



Framework for education in

Progressing through the sustainability problem-solving framework and levels of competence attainment



transdisciplinary learning processes (adapted from Lang et al., 2012)

Semantic noise in sustainability

- literature on competencies in education for sustainability, " is characterized by a sea of labels, terminological confusion, and relative inattention to pedagogic implications."

  Sterling, S., Glasser, H., Rieckmann, M., & Warwick, P. (2017, 153)

- "synonymous concepts are, for example, skills and qualifications, literacy and capabilities. What they all have in common is a focus on the abilities that allow us to master even unforeseen demands and thus distinguish themselves from 'laundry lists' of abilities, which we typically find with certain job profiles. Barth (2015, 61)

- "miscommunication or misunderstanding of concepts within this field of enquiry is contributing to slow progress towards the objectives of HESD (higher education for sustainable development)" –Shephard, K., Rieckmann M., & Barth, M. (2018)

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.

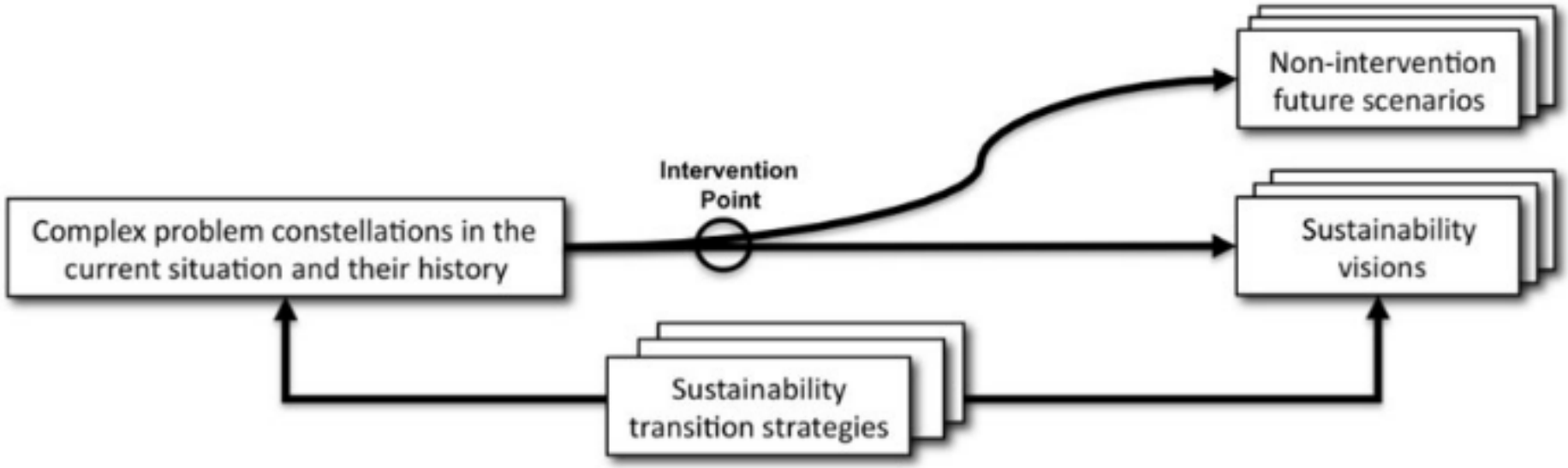
Sustainability competencies and learning activities

sustainability education as learning to collectively address sustainability challenges

SDGs as an assemblage of sustainability challenges to address

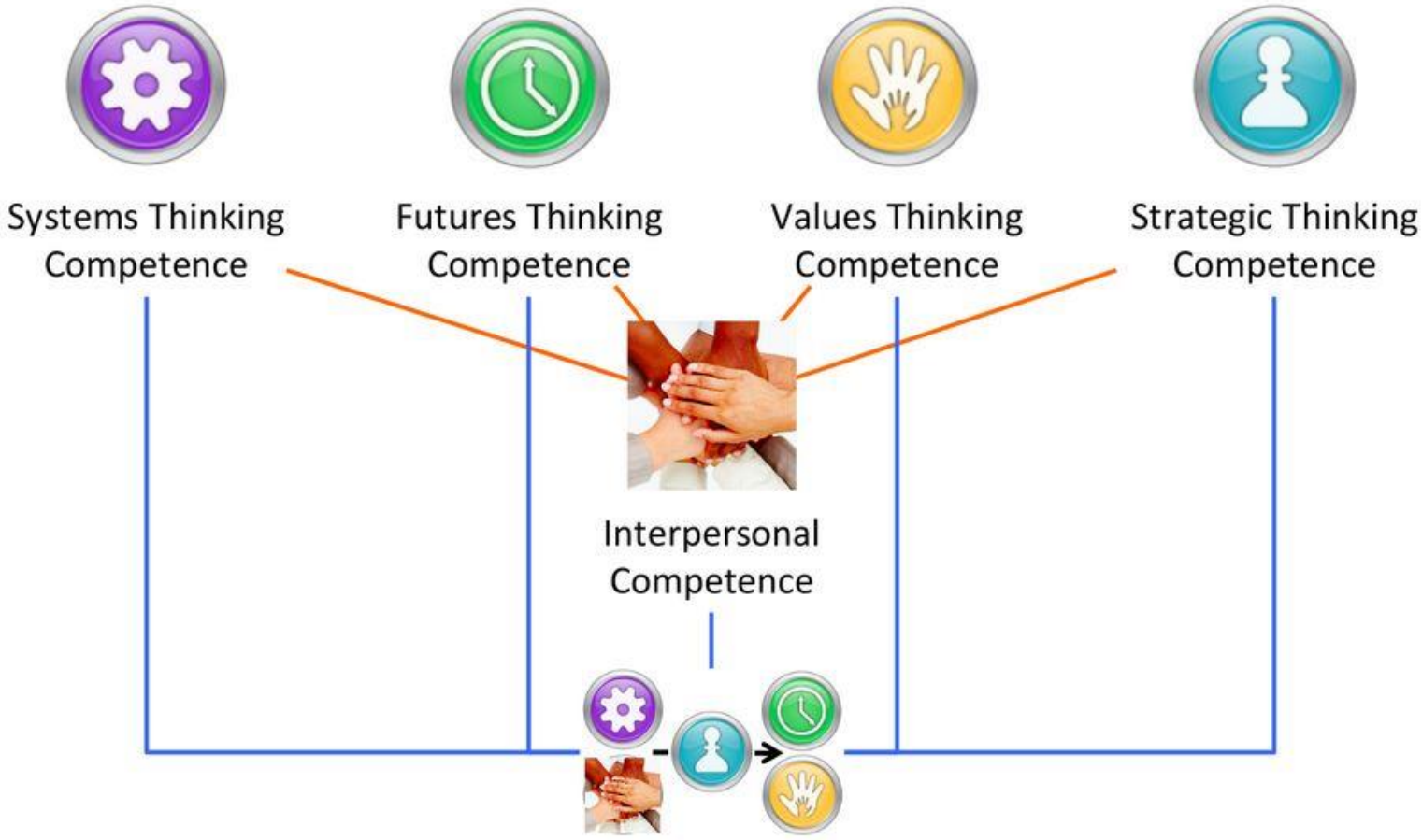
The most widely read and used framework: Wiek et al., 2011

Sustainability Problem—Solving



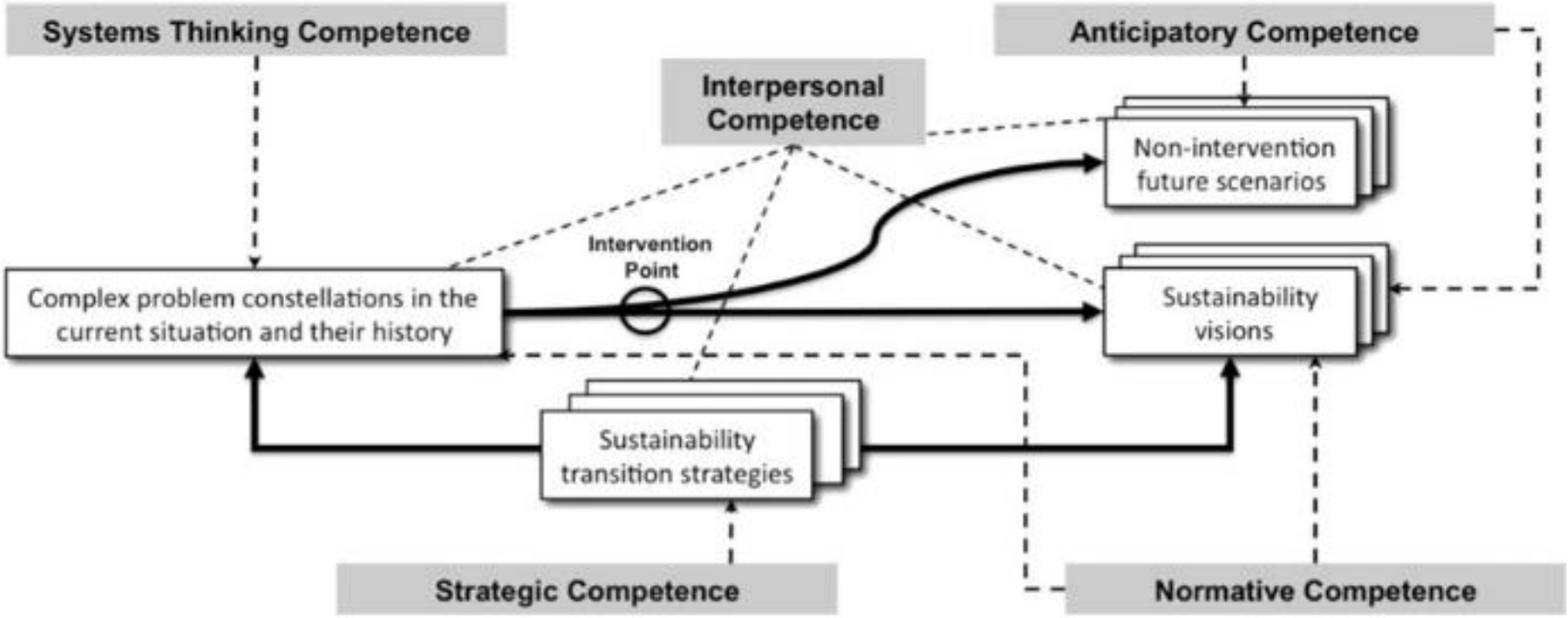
Source: Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*, 6(2), 203–218. http://doi.org/10.1007/s11625-011-0132-6

6 Core Competencies in Sustainability



Source: Wiek et al. 2011

Sustainability Problem—Solving Capacity



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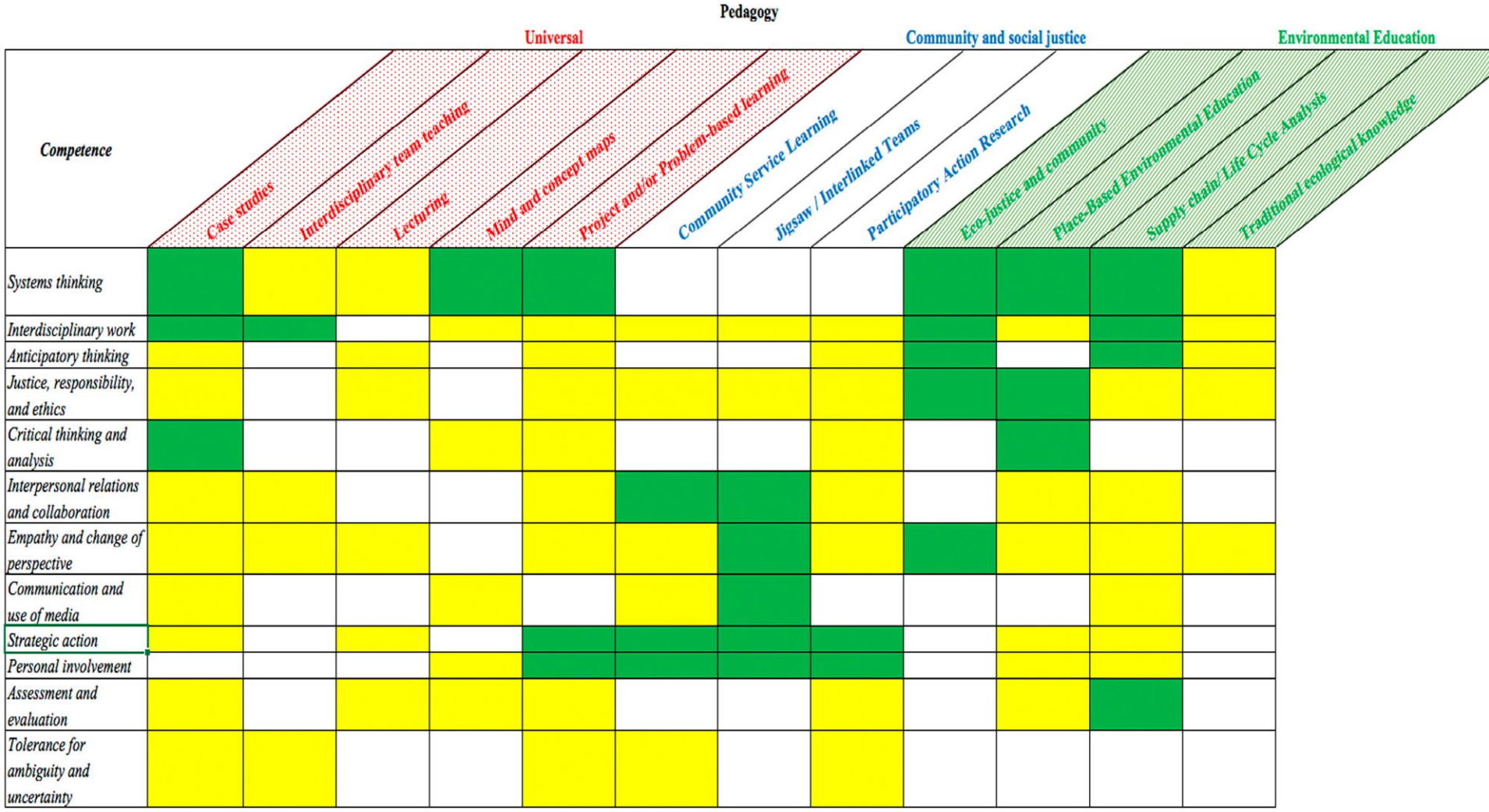
Pedagogy can address the noise in helping students understand and attain sustainability competence

"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

Connecting core competences to learner activities



Lozano et al., 2017

doesn't display interactions between competencies and within learning activities

Pedagogy can address the noise in helping students understand and attain sustainability competence

perception 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

LEARNING AND TEACHING FOR ENVIRONMENT AND SUSTAINABILITY

Australian Government | Office for Learning & Teaching

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

Communication with over 1000 stakeholders

Over 250 individuals actively collaborated in the development of the standards by providing over 2500 separate pieces of advice and guidance

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

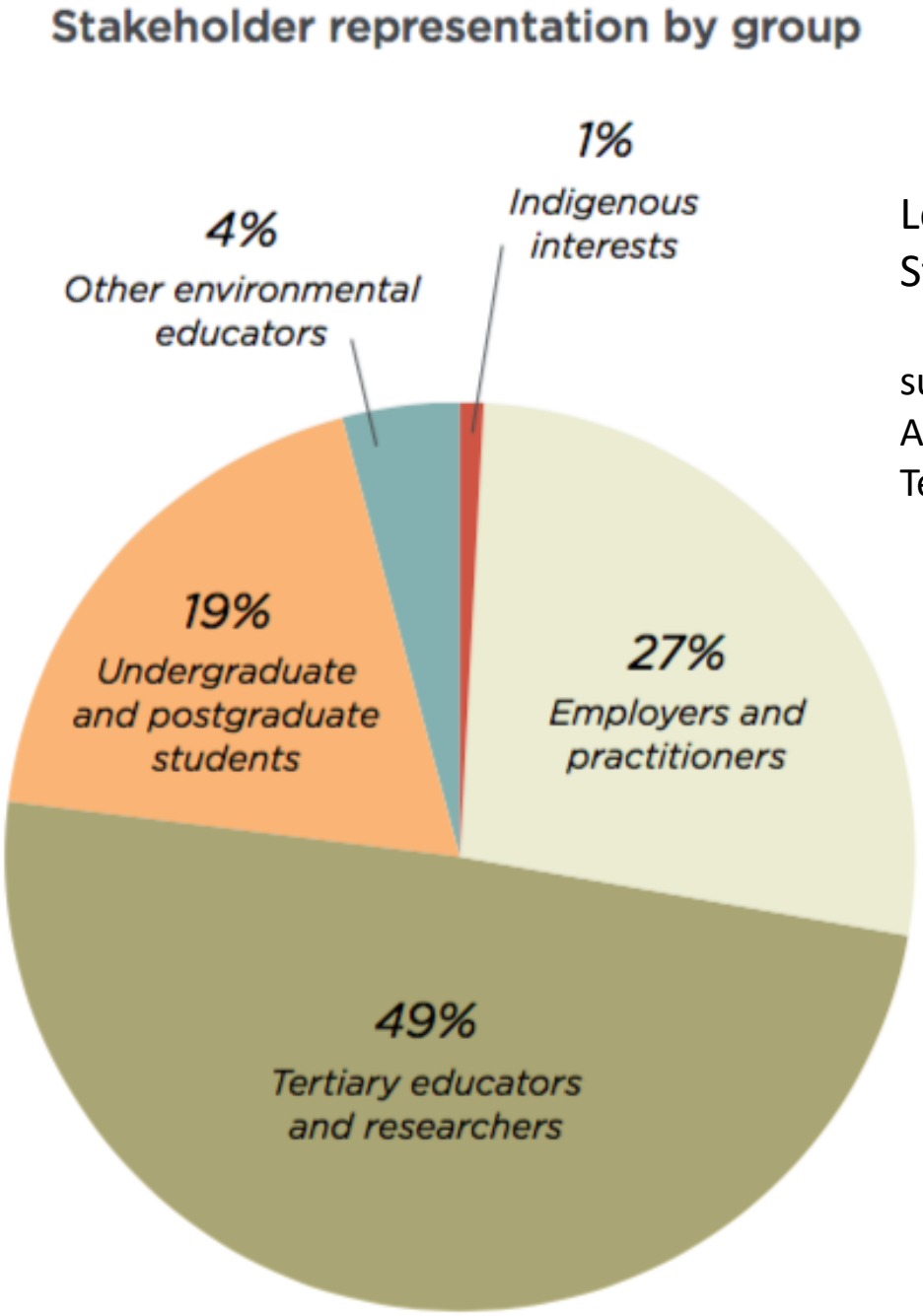
This was a 12-month project, commissioned by the Australian Council of Environmental Deans and Directors. This project was a collaboration of the University of Newcastle (lead institution), Australian National University, Flinders University, Macquarie University and University of New South Wales. Support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

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.



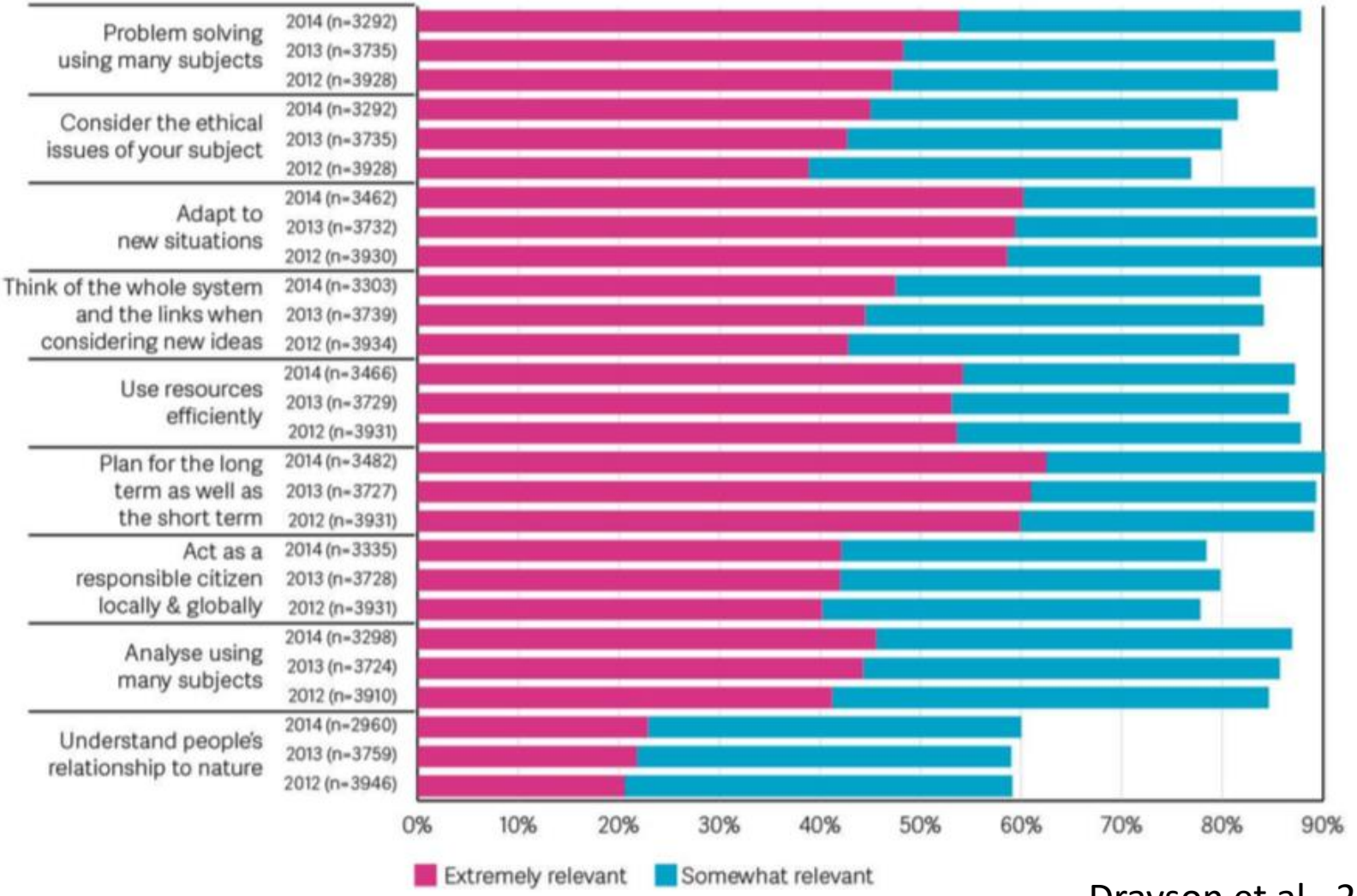
Learning and Teaching Academic Standards Statement for Environment and Sustainability

support for this project has been provided by the Australian Government Office for Learning and Teaching.

https://environmentltas.gradschool.edu.au

Student attitudes towards skills for sustainable development

Figure 7.1 | Thinking only of your own personal view, how relevant is it to you that the following skills are developed through your university/college education? [2012 COHORT]



Drayson et al., 2015

Conclusions on Students attitudes & skills for sustainable development

- Overwhelmingly skills in sustainable development are seen as **valued by employers**
- Wider, core skills seen as more important/relevant than sustainability-specific skills
- Preference for improving **employability skills over deepening subject knowledge changes**
- Reframe existing courses rather than add additional courses
- Understand the mismatch in definitions of SD between students and academics/policy-makers will be key when developing curricula, mechanisms, and resources for delivery.

Drayson et al., 2015

Normativity in Sustainability

Does an academic sustainability program teach specific values, and is this made explicit?

Divergent views exist:

- the normative character of sustainability requires the acquisition of certain values (social-ecological integrity, justice, etc.).
- sustainability graduates need to know different value-laden concepts, but their role is to facilitate dialogue rather than position themselves in value-laden debates

Source: Wiek et al. 2011: 212.

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

Sustainability change agents self-identify with the desire to act for positive change, 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)

Sustainability Change Agents

”A change agent for sustainability is an actor who *deliberately tackles* social and ecological problems with *entrepreneurial means* to put sustainability management into organizational practice and to contribute to a sustainable development of the economy and society”.

- Develops sustainability as a factor of success in their working environment
- Initiates sustainability projects which enact substantial change in the organization and beyond
- Transfers the vision of sustainable development through cooperation and public relations
- Works in multiple roles (sustainability expert, facilitator, catalyst and activist)

(Hesselbarth & Schaltegger, 2014, after Caldwell, 2003)

Sustainability Learning Environments

If student ***self-identifies*** as change agent for sustainability, deliberately tackling social and ecological problems with entrepreneurial means, …

- How engaged should the learner be in designing and implementing the educational process?
- How important is it to articulate the underlying competences and the purposed of learning activities used to achieve them?

the NCSE core competencies consensus statement

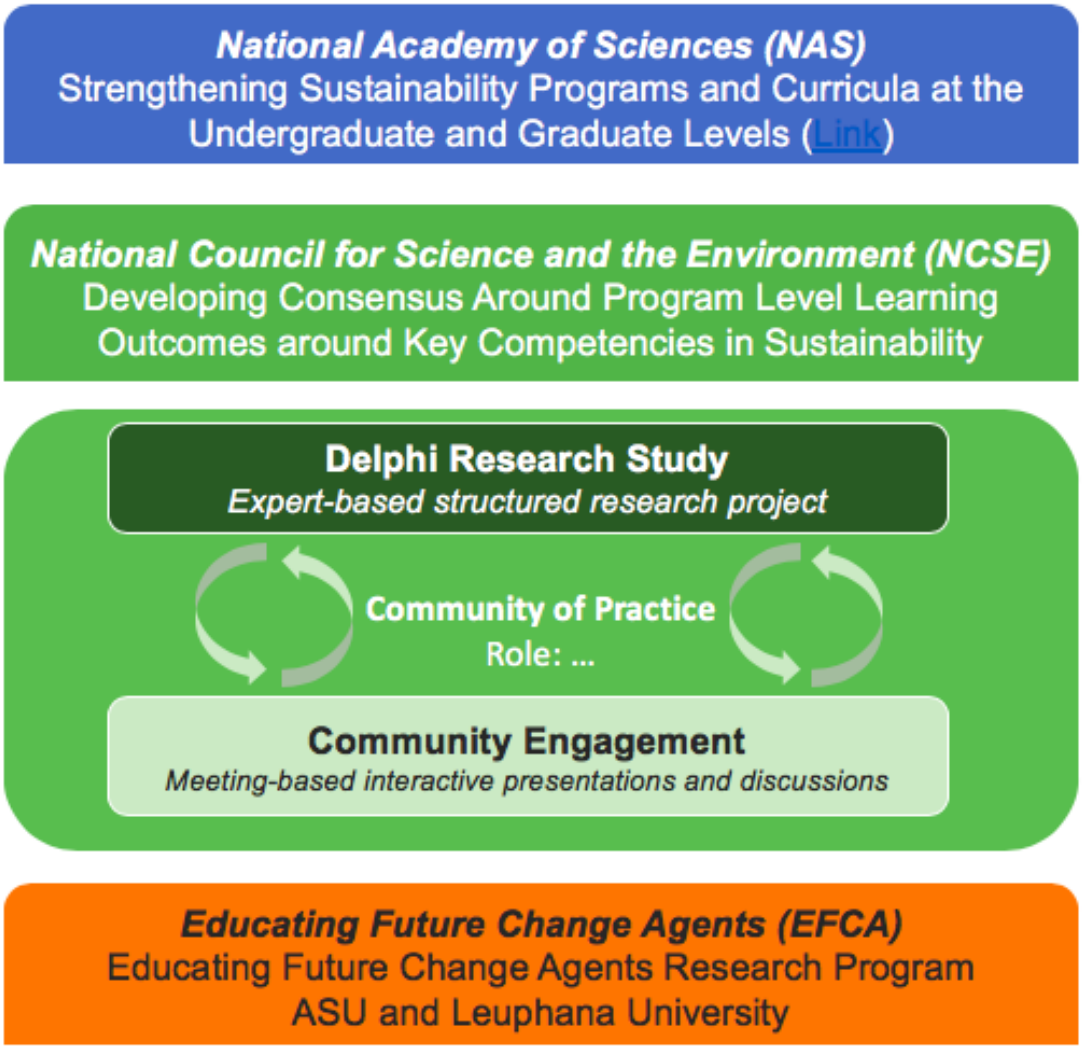
virtual workshops through the Sustainability Curriculum Consortium, a survey of dozens of experts, and in-person workshops at meetings including AASHE, SCC, and NCSE to gather a wide range of informed, expert opinions.

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 including ***environmental and sustainability studies and sciences programs***: holistic approach to environmental and sustainability problem-solving

Organization and timeline



Consensus Statement for NCSE endorsement

2018 → 2019 → 2020 →

Very initial conclusions/recommendations from NCSE survey

Focus on education programs that enable change management

Change management is a key theme that emerges, across all organization sizes and types. Sustainability professionals recognize the enormous task of bringing about change, and seek skills to help them do just that.

As a result, “soft” skills such as communication, facilitation, consensus building and networking are of especially high value by the group. Demonstrating financial viability and return on investment are considered important enablers of change.

Educational programs should stress these as “core” skills, and recognize subtleties between bringing about change *within* organizations and externally.

Tailor programs to teach “hard” skills valued by industry

Aside from planning and project management, many “hard” skills vary in importance by industry. Create tracks for professionals of various types where they can develop expertise that is specific to their type of business or organization.

Leverage skills of current professionals as educators and mentors

Many current sustainability professionals have deep experience in the field. Enlist their efforts as program planners, educators and mentors in this emerging profession.

for discussion

Frameworks

in general education: engaged citizens, change agents?

in our programs: change agents, engaged citizens, sustainability professionals?

Do we differentiate types as well as levels of competencies for general education from those in sustainability & environmental programs

Competencies Structures: differentiating lists and frameworks

Lists of individual competencies

ACEDD, Garcia et al., (2017), Lozano et al., 2017, UNECE, 2012, etc.

Frameworks

key competencies in sustainability (Wiek et al., 2011) that assemble and integrate individual competencies into a structured approach to problem-solving

Normative Competencies, beyond professional ethics

how to assess, while recognizing a duality in normativity. Sustainability education requires students to be able to

1) Recognize explicit & implicit values, including their own, and how these values influence decisions to facilitate collaboration
2) Reflect how their own values relate to sustainability values like the SDGs (justice, socio-ecological integrity, etc.)

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