What Do Key Competencies in Sustainability Offer and How to Use Them

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Abstract

Scholars and educators largely agree on a framework that integrates a small set of key competencies in sustainability as learning objectives for courses and programs in higher education. However, the current practice of using these key competencies often falls short due to insufficient competence coverage and integration, competence operationalization, alignment between competencies and pedagogies, assessment of competence development, and assessment of professional success. Herein, we briefly review these shortcomings and outline ways to overcome them, including institutional reforms—providing guidance to scholars, educators, and administrators on how to improve competencies-based educational practice and better contribute to advancing sustainability.

Agreement on Key Competencies in Sustainability

Multiple recent literature and expert studies have confirmed convergence among educational scholars and practitioners on a framework for key competencies in sustainability that can guide academic program development and course design, as well as assessment and accreditation procedures. This framework was first introduced a decade ago by Wiek et al. (2011a) and then further developed in Wiek et al. (2016). It caught the attention of educational scholars and practitioners as indicated in a recent bibliometric study by Grosseck et al. (2019) identifying the Wiek et al. (2011a) article as the "most influential paper" (p. 26) in the field of Education for Sustainable Development (ESD) in the past decade. A recent study by the United States National Academies (2020) used this framework, which is intended to enable students to solve sustainability problems (or, in other words, "to design, implement, and lead proactive change toward a sustainable world," p. 114), as a main reference for developing their recommendations on "strengthening

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sustainability curricula and programs in higher education […] and developing a sustainability workforce" (p. viii). A recent study by the European Commission's Joint Research Centre (Bianchi, 2020) refers to this framework as the one that has "set the stage for future works and has often been used by scholars as the foundation for any attempt to describe sustainability competences" (p. 13). Brundiers et al. (2021) conducted a Delphi study with experts from around the world on this framework, revealing broad agreement on "the purpose, namely, to enable and empower students to become effective in positively contributing to sustainability problemsolving […]; […] defining the competency-related knowledge, skills, motives, and attitudes independent of and complementary to sustainability topics; the integration of the key competencies into a sustainability problem-solving framework […]; and the introductory set of learning objectives for each of the key competencies." And a recent review of the peer-reviewed literature 2011–2020 (Redman and Wiek 2021) found that Wiek et al. (2011a) have been cited by 63% (n = 141) of the sampled articles published after it (*n* = 225)—that is far more than any other article—and that it has "facilitated explicit convergence," being used as full foundation in 32 articles (14% of the sampled articles) and as partial foundation in 78 articles (35%).

Wiek et al. (2011a and 2016) synthesized literature into a framework of sustainability problem-solving competence, integrating six key competencies, namely systems thinking, anticipatory, normative, strategic, interpersonal/collaborative, and integrated problem-solving competencies, plus basic competencies such as critical-thinking competence. The framework was operationalized into detailed learning objectives in Wiek et al. (2016). The core of this framework has been consistently confirmed. For example, in a UNESCO publication, Rieckmann (2018) describes the conversion of competencies literature as follows (cf. UNESCO 2017): "There is general agreement within the international ESD discourse that the following key sustainability competencies are of particular importance for thinking and acting in favour of sustainable

development: systems thinking competency […], anticipatory competency […], normative competency […], strategic competency […], collaboration competency […], critical thinking competency […], self-awareness competency […], integrated problem-solving competency […]" (pp. 44–45). Two recent comprehensive studies convened experts (Brundiers et al. 2021) and reviewed the literature (Redman and Wiek 2021) to consolidate the many proposals for expanding the key competencies framework which have been made over the past decade. These studies independently suggested adding three competencies, namely intrapersonal competence (cf. self-awareness competence), integration competence, and implementation competence; to hierarchically structure the competencies; and to specify learning objectives for students interested in a career as sustainability researcher; among others. Both studies synthesize their findings into extended versions of the key competencies framework; the one by Redman and Wiek (2021) is captured in Fig. 4.1.

While there is abundant literature on competencies in sustainability, there is only little, by comparison, on the strengths and weaknesses of putting them into practice—which is the focus of the present chapter.

Flaws in Current Practices

While the key competencies are widely used in sustainability courses and programs around the world, implementation is often flawed (e.g., Trencher et al. 2018; Redman et al. 2021). We briefly review some of the prominent pitfalls in adopting the key competencies framework in educational practice. The insights are partly extracted from literature, but mostly based on direct observations or informal exchanges with numerous colleagues from different universities that offer sustainability programs.

Insufficient Competence Coverage and Integration Sustainability programs and courses often disaggregate the key competencies framework and treat it as a "grocery list" from which to
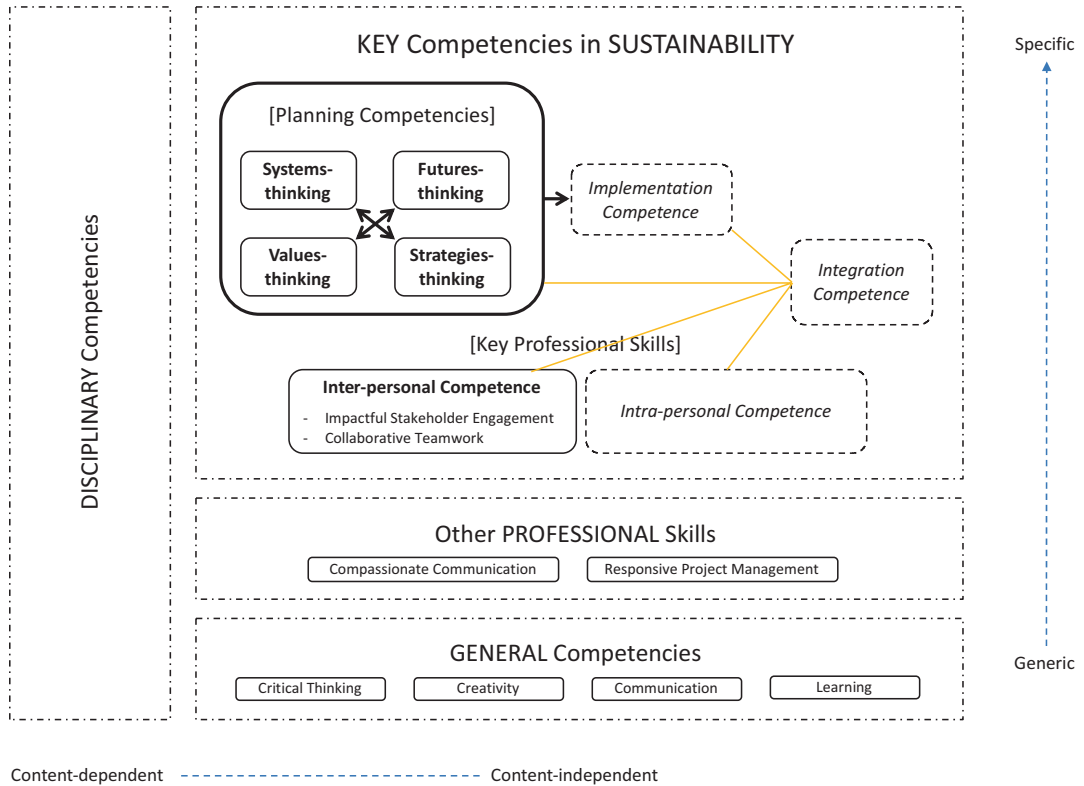
Fig. 4.1 Integrated framework of competencies for advancing sustainability transformations; centered on 8 key competencies in sustainability with 5 established (bold) [based on Wiek et al., 2011b] and 3 emerging (italic); and complemented by disciplinary, general, and other professional competencies (Source: Redman and Wiek 2021)

pick and choose (Redman and Wiek 2021). And scientific reviews have done so, too (e.g., Lozano et al. 2017, p. 4: "Wiek et al. (2011a) compiled a *list* of key competences for SD."). However, a critical feature of this *framework*, as emphasized in all publications on it, is the *integration of* the individual key competencies for sustainability problem-solving. Lack of covering *all* key competencies and conveying how to best *combine* them inevitably leads to students' deficits in sustainability problem-solving competence. Graduates might become proficient systems thinkers, but not sustainability problem-solvers. This uneven coverage of the key competencies was revealed, for example, in a recent study of 45 Master's programs in sustainability, which, for instance, hardly stimulated development of antic-

ipatory competence (Salovaara et al. 2020). In addition, there is a general tendency across sustainability programs and courses to either neglect or underemphasize interpersonal competence development, i.e., teamwork and stakeholder engagement (second least addressed, according to Salovaara et al. 2020). Lip service is being paid to their importance for real-world sustainability problem solving but there are very few sustainability programs that offer a structured pathway for students to develop a proficient level of interpersonal competence concurrently to all other key competencies. The recently suggested additional competencies (intrapersonal competence, etc.) are even less covered and integrated into overall sustainability problem-solving education.

Insufficient Competence Operationalization It continues to be common practice that course instructors and program administrators refer in vague and abstract terms to the key competencies at the beginning of their sustainability course syllabi and course introductions (Brundiers and Wiek 2013). Detailed operationalization of the key competencies (and their inter-play) into specific learning objectives that guide courses throughout the term is often missing. This operationalization is typically left up to instructors who are ill-equipped and supported for the task (Wilhelm et al. 2019). Even if there are program-level learning objectives (PLLOs) determined for sustainability programs, there is rarely a follow-through to what extent these objectives are being covered in the individual courses as well as in the curriculum overall. This leads to a number of deficits: first, instructors and students struggle with distinguishing the key competencies from each other and from other competencies (for example, from general competencies such as critical thinking) as well as clearly relating them to each other; second, there is a gap that remains between the overall learning aspiration (problem-solving competence) and the daily educational practice (isolated competencies); third, students often have a hard time grasping the relevance of the key competencies for their education and future professional practice; and fourth, there is no base for rigorous and comparative assessments of students' acquisition of the key competencies (across different courses and programs).

Insufficient Alignment Between Competencies and Pedagogies As key competencies and learning objectives pertaining to them remain vague, it is almost impossible to adopt the most effective pedagogies to support students in developing them (cf. Lozano et al. 2017). Constructive alignment of pedagogies to match the ambitious and different nature of key competencies (compared to traditional content-based learning objectives) is all too often insufficient (Wilhelm et al. 2019). For example, students' development of anticipatory competence should be supported by imagination and creativity didactics, while normative

competencies might best be developed through discursive and deliberative didactics, and inter-personal competencies through experiential and project-based didactics. Additional effort needs to be devoted to pedagogies that build the attitudinal component of key competencies as well as intrapersonal competence. While part of this shortcoming can be credited to the previous one (lack of competence operationalization), many sustainability programs struggle with familiarizing their teaching staff with advanced and up-to-date pedagogical concepts and techniques through advanced trainings as well as supporting and fully embracing their use and implications (Wilhelm et al. 2019). The mantra of "a good researcher is a good teacher" prevails in academia despite plenty of evidence to the contrary. Even if the key competencies are adequately operationalized, insufficient alignment of pedagogies leads to students' deficits in sustainability problem-solving competence. Pointing to the contrary, initial screening and evaluations indicate that there are still significant gaps in supporting students in developing key competencies in sustainability programs (Trencher et al. 2018; Salovaara et al. 2020; Redman et al. 2021).

Insufficient Assessment of Competence Development Many sustainability programs and courses lack rigorous assessments of students' key competencies in sustainability, as, for the most part, scaled self-assessment by the students themselves prevails (Redman et al. 2021). Again, this is due, in part, to deficits mentioned above—an "error reproduction" in constructive alignment of competencies, pedagogies, and assessments. Many instructors retreat to subjective assessment measures (by the students themselves) because the learning objectives are insufficiently operationalized, and the course pedagogy is insufficiently aligned with the learning objectives (cf. Lozano et al. 2017). The current lack of objective assessments results also leads to frustration among students left with few ways to demonstrate success in acquiring the key competencies and little opportunity for making a compelling case to future employers. Current educational

practice does not show any regular use of assessment instruments that yield objective results of students' competence acquisition across courses within a program or across programs (to indicate pedagogical quality of courses and programs).

Insufficient Assessment of Professional Success Finally, while there is a significant gap in rigorously assessing students' development of key competencies in sustainability programs, there is practically none in professional practice (Sandri et al. 2018). So, how do we actually know that students have acquired sustainability problem-solving competence through their education? We don't. Success in professional practice through real positive impacts is supposed to be the main reference of successful education—namely, that graduates are actually able to contribute to sustainability problem solving in the real world (not only demonstrate it through proxies in academic programs). Little is being done to evaluate the success of sustainability problem-solvers after graduation, in particular, around the key competencies framework. Obviously, there are logistical challenges, but if we are not able to provide this kind of evidence, doubts will rightfully remain regarding pedagogical effectiveness and efficiency of sustainability courses and programs.

Good Practices

While there are many challenges to effectively applying the key competencies framework in educational practice, there are also a number of robust practices to counter them, which we present below.

Covering and Integrating Competencies Sustainability curricula ought to cover all competencies sufficiently and integrate them so as to deliver on the promise to educate students in sustainability problem-solving competence. The first step is to make sure that all the individual courses do so in conjunction (competencies-oriented curriculum planning). In a second step,

some individual courses will need to be designed in a way that they explicitly integrate key competencies in ways which allow students to develop and apply them *in combination* to solve sustainability problems (e.g., in project-based, solution-oriented courses). Advanced (graduate) courses might even cover a number of different sustainability problem-solving frameworks (Wiek and Lang 2016). On the curriculum level, it might be helpful for students and instructors to develop several distinct student "roadmaps" that outline *how* students are expected to successively acquire sustainability problem-solving competence as they move through the program. Considering the importance of interpersonal competence for sustainability professionals, attention should be paid to explicating pathways to develop interpersonal competence over the course of the program (Brundiers et al. 2010).

Operationalizing the Competencies Based on competencies-oriented curriculum planning (see above), it is critical to operationalize the key competencies in specific learning objectives relevant to each course (Brundiers and Wiek 2013). It might help to start from previous operationalizations (Wiek et al. 2016; Brundiers et al. 2021) and adapt them to the specific course content. Course-specific competence operationalization through learning objectives allows for making the key competencies tangible and relevant to students as well as external stakeholders (e.g., auditors, employers). This also enables instructors to conduct rigorous assessments of students' competence acquisition throughout and at the end of the term (Redman et al. 2021). Ideally, the specific learning objectives of each course would be coordinated across the curriculum to secure a sufficient, but not too high level of redundancy (reinforcement).

Aligning Pedagogies to Competencies A success factor for formulating and then teaching toward specific learning objectives directly tied to the key competencies is, obviously, that alignment is sufficiently operationalized

(Lozano et al. 2017) and that the teaching staff is sufficiently trained to implement such alignment (Wiek et al. 2011b; Barth and Rieckmann 2012; Rieckmann 2018). This requires awareness by course instructors that a "one-size-fits-all" approach to pedagogy is inappropriate for teaching the diverse set of key competencies. It also requires from administrators and institutions to put more emphasis on, and develop regular offerings in, initial and continuous pedagogical education for instructors in sustainability programs (Barth and Rieckmann 2012; Scherak and Rieckmann 2020; Weiss et al. 2021). Finally, auditing and evaluations about the suitability of employed pedagogies during courses and ex-post allow for continuous capacity building and improvements of educational practice.

Assessing Competence Development Assessments of students' acquisition of the individual key competencies as well as overall sustainability problem-solving competence can utilize a number of different tools (Rieckmann 2018; Redman et al. 2021). Tools range from *self-perceiving-based* procedures (e.g., reflective writing) that allow students to assess their own competence level and/or development; through *observation-based* procedures (e.g., performance observation) for which instructors or experts assess students' competencies; to *test-based* assessment procedures (e.g., scenario/case test) which use a predefined set of criteria (or "correct" answers) to assess students' competencies. Good practices include making sure that assessments rely on sufficiently operationalized competencies (see above); that instructors are comfortable with the assessment tools through previous familiarization and training; that assessment tools are used in support of students' learning, thus, applied formatively rather than ex-post; and that, ideally, multiple tools are being used in order to triangulate assessment results for increased validity and reliability (particularly relevant when using self-perceiving-based procedures).

Assessing Professional Success Simulating professional situations and asking students to perform within them has been introduced as a pedagogical approach—at times explicitly borrowing from medical, social work, or management education—for advancing students' learning of competencies, including those related to sustainability (Foucrier and Wiek 2020; Redman et al. 2021). This has been called for previously and concurrently to the development of the key competencies concept (Wiek et al. 2011b). It requires significant preparation on the instructors' part, but initial evaluation indicates the added value of these investments (Foucrier and Wiek 2020). Ideally, such pedagogical and assessment approaches would be extended to actual professional practice, for instance, in collaboration with program alumni working as sustainability professionals. A key success factor for this advanced educational practice would be to feed the results back into course and curriculum design for enhanced pedagogical effectiveness and efficiency.

Outlook

Failure or success in adopting the framework of key competencies in sustainability often comes down to the level of institutional support and incentives at universities (Weiss et al. 2021) as well as the wider institutional and political context (United States National Academies 2020). Already a decade ago it was noted and outlined, concurrently with the original development of the key competencies framework, what institutional support might be critical for advancing education for sustainability problem solving (Wiek et al. 2011b). There are a number of supportive institutional structures that universities can adopt, including faculty training, promotion and tenure criteria, and financial incentives (Rieckmann 2018). Institutional inertia and individuals' reluctance have resulted in too few changes in educational practice over the past decade but junior faculty seem to be more willing to adopt good practices, in particular when they were them-

selves educated in genuine sustainability programs.

While more momentum needs to be created in changing the educational practice and underlying drivers, from institutional support to individual responsibility, one aspect we feel compelled to advise against: *no more reinventing competencies in sustainability!* There is so much work to be done to make the practice of sustainability education more effective and efficient, before running out of time, that all of our collective effort should shift there. The existing convergence on a framework of key competencies in sustainability problem solving seems sufficient for moving forward on advancing the educational practice that the well-being of people and planet depends upon, at least to a significant extent.

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