Closing the sustainability skills gap: Workforce perspectives on the key competencies in sustainability from the Global Council for Science and the Environment's Sustainability Education Initiative

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Introduction

The coming generation of college graduates faces a host of complex scenarios for how sustainability challenges such as climate change, social injustice, and evolving technologies will shape their future. In response to these challenges, there is an urgent and expansive demand for workers capable of implementing sustainability projects across sectors, industries, and contexts.[1] Students will need to develop the skills that enable them to address complex problems and advance solutions that contribute to more sustainable environmental, social, and economic futures. However, the capacity and efficacy of higher education[2] in preparing students with the necessary "sustainability skills" has struggled to meet workforce demand, creating a misalignment now referred to as the "sustainability skills gap".[3]

Taking a closer look at the "sustainability skills gap" and how to "close" it reveals a more nuanced analysis of what this gap entails, the factors that have driven its emergence, and the possible strategies to address it. The sustainability skills gap is not merely a reality of insufficient quantity of college graduates with these abilities, nor is it a question of ineffectual quality of higher education opportunities. Instead, the sustainability skills gap is a product of the confluence of dynamic trends in higher education, the sustainability workforce, and ways of understanding their intersection.

In this paper, we integrate theoretical and practical insights to analyze the sustainability skills gap and determine potential approaches for addressing its complexities. We draw on our work with the Global Council for Science and the Environment's Sustainability Education Initiative (GCSE SEI), which aims to establish best practices related to the design and evaluation of sustainability programs in higher education to support their ability to better prepare students for the emerging sustainability workforce. In this initiative, GCSE implements an inclusive participation approach to engage a broad range of stakeholders - including faculty, program administrators, employers, and current professionals - to inform their understanding of needs and opportunities to strengthen responses to the sustainability skills gap.

We focus on the ways that the GCSE SEI is negotiating different aspects of the gap to create greater synergy between higher education and the emerging sustainability workforce. We address limitations in higher education that present challenges to closing the gap, including possibilities for greater clarity in relevant types of jobs, the programs that prepare students for these professions, and the necessary skills for graduates. Specifically, we highlight the key

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[1] Microsoft, *Closing the Sustainability Skills Gap: Helping businesses move from pledges to progress*, (Microsoft, 2022).

[2] In this paper, we focus on the connection between higher education and the emerging sustainability workforce, as this is a central focus of our work as part of the Global Council for Science and the Environment's Sustainability Education Initiatives. However, there is a growing area of training opportunities for aspiring sustainability professionals that has developed outside of the higher education space to offer upskilling through certificate programs and other types of credentials. For further details on this space, which is interconnected to but ultimately outside the specific scope of this paper, see the work of Keniry (2020) and the efforts of the New Green Learning Agenda by Kwauk & Casey (2021).

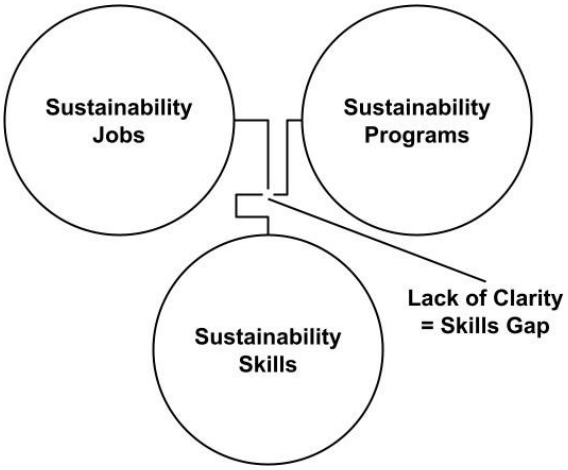
[3] Chris Boone and Karen C. Seto, "Green jobs are booming, but too few employees have sustainability skills to fill them – here are 4 ways to close the gap", *The Conversation*, January 5, 2023.

competencies in sustainability[4] as a potentially unifying framework to provide dynamic guidance for higher education programs, employers, and professionals in developing the skills needed to address complex sustainability problems.

Sustainability Skills Gap: Challenges and Opportunities

Building from the work of Boone and Seto,[5] we argue that the sustainability skills gap has emerged due to a lack of clarity in three areas: (1) sustainability jobs, (2) sustainability programs in higher education, and (3) the sustainability skills developed by students as future professionals (Figure 1). We briefly consider the challenges that have contributed to this lack of clarity in each area before considering opportunities to create greater alignment between them.

Figure 1: Lack of Clarity in Three Areas Contributes to the Sustainability Skills Gap



As the relevance and quantity of sustainability-related jobs increases, the demand for higher education to generate sustainability skills in the workforce is also amplified.[6] A fundamental challenge to addressing the gap that has emerged comes in even defining "sustainability" and/or "green" jobs themselves. While the *Future of Jobs Report 2023*, published by the World Economic Forum, highlighted these types of jobs as among the top ten fast-growing positions in the world,[7] setting standards as to what they entail has remained a complicated process. The wide range of jobs described as green or sustainability-focused (Table 1) undermines clear distinction of how sustainability positions address intertwined environmental, social, economic, and governance issues, particularly as the sustainability/green label is applied to increasingly varied roles.[8] We suggest that emphasizing the integrated nature of *sustainability* jobs, which go beyond the often environmental- or technical-centric understandings of "green" jobs, represents a beneficial step forward in the discourse to define the parameters of positions that address sustainability challenges.[9] Without greater clarity in the responsibilities and objectives of these types of jobs, higher education programs may continue to struggle to determine how to prepare students with the necessary skill set, whether this

[4] Katja Brundiers et al., "Key competencies in sustainability in higher education: Toward an agreed-upon reference framework", *Sustainability Science* 16 (2021): 13-29. Aaron Redman and Arnim Wiek. "Competencies for advancing transformations towards sustainability," *Frontiers in Education* 6 (2021): 785163.

[5] Boone and Seto, "Green jobs are booming"

[6] LinkedIn, *LinkedIn Global Green Skills Report* (LinkedIn, 2022).

[7] World Economic Forum, *The Future of Jobs Report 2023* (World Economic Forum, 2023).

[8] Boone and Seto, "Green jobs are booming"

[9] Christopher G. Boone, Erin Bromaghim, and Anne R. Kapuscinski. "Sustainability careers," *Annual Review of Environment and Resources* 48, no. 1.

requires broad (holistic) or deep (specialized) knowledge of sustainability.[10] Despite these challenges, the diversity of positions and professions that are engaging with sustainability presents an opportunity to situate sustainability as an essential factor in the development of all individuals preparing for jobs in the rapidly evolving economy, especially in roles that emphasize the social dimensions of sustainability.[11] This opportunity is particularly prevalent for the growing demand from a greater racial and ethnic diversity of individuals seeking employment in the sustainability field.[12]

Table 1: Example Definitions of Green and Sustainability Jobs

Source	**Definition**
LinkedIn (2022)	Green jobs are “those that enable the environmental sustainability of economic activities”.
International Labour Organization (2016)	Green jobs are decent jobs that contribute to preserving or restoring the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency.
World Economic Forum (2023)	Green jobs require specific “green skills” and are “crucial for enabling a transition to a more sustainable economy”.
United Nations Environment Programme (2011)	Green jobs entail “work in agricultural, manufacturing, research and development, administrative, and service activities that contribute substantially to preserving or restoring environmental quality” and help to “protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; decarbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.”
US Bureau of Labor Statistics (2013)	Green jobs are either: (a) jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources, or (b) jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.
National Academy of Sciences, Engineering, and Medicine (2020)	Sustainability jobs are those that entail the “ability to design, implement, and lead proactive change toward a sustainable world” by being able to “translate knowledge to effective action to meet emerging local, regional, national, and global needs”.
Boone et al. (2023)	Green jobs are “jobs that reduce negative environmental impacts”. Sustainability jobs are “jobs that improve human well-being and strengthen social equity, while reducing environmental harms”.

[10] Microsoft, *Closing the Sustainability Skills Gap*

[11] Amanda Novello and Greg Carlock. *Redefining Green Jobs for a Sustainable Economy* (The Century Foundation, 2019).

[12] Heather Mak, *The state of equity, diversity and inclusion in sustainability*, (Diversity in Sustainability, 2021).

The second challenge has been a lack of clarity in the ways that higher education programs can develop students to contribute to a sustainability-oriented workforce by meeting the quantity and quality demands from employers. These demands raise the need for "effective and accessible" training for students in interdisciplinary programs that enable smooth transitions to a variety of sustainability-focused roles.[13] However, several barriers impede the progress of higher education programs to meet these needs. These include: persistent inequities in access to quality higher education and early career support, particularly to marginalized groups;[14] lack of knowledge and competencies for faculty and program leaders to design and deliver relevant educational experiences;[15] an overemphasis on cognitive knowledge and technical skills, rather than solution-oriented competencies and dispositions;[16] and a lack of exchange between academia and employers/practitioners to align needed skillsets.[17] The rapid proliferation of sustainability-related programs in higher education[18] complicates these issues and raises questions of quality, accessibility, and impact, especially with a lack of consistency in the structure and objectives of these programs.[19]. Yet, the diversity of options for students across different aspects of the curriculum and modes of delivery presents an opportunity for both cross-cutting and deeper engagement with sustainability as an educational topic and professional concern.[20]

The third challenge centers on a lack of clarity in the necessary skills for students to develop as sustainability professionals to successfully address complex problems in a range of fields and contexts. Due to the variety of sustainability jobs and the disparity in sustainability programs, establishing a clearly-defined set of sustainability skills and developing them through higher education has proved challenging. However, recent work has demonstrated convergence around an interrelated set of abilities that can guide programs and employers in this area. This work has highlighted the utility of the shared reference framework on key competencies in sustainability (KCS), which outlines the fundamental capacities for sustainability professionals to iteratively and collectively solve complex problems.

We suggest that the KCS provides a tool to close the sustainability skills gap by creating greater clarity on the skills that higher education programs can seek to develop in students to prepare them for a variety of jobs. Specifically, the KCS framework can be leveraged to clarify and align sustainability jobs, programs, and skills (Figure 2) by: (1) describing the *problem-solving process* and related abilities to iteratively and collectively address sustainability issues, (2) providing dynamic guidance for higher education on *program-level learning objectives* related to sustainability, and (3) detailing *professional skills* for a variety of sustainability-focused jobs across a range of contexts. Applying the key competencies in sustainability framework through diverse lenses (employers, program leaders, students,

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[13] Boone and Seto, "Green jobs are booming"

[14] Mak, *The state of equity, diversity and inclusion*

[15] Wendy Maria Purcell Heather Henriksen and John D. Spengler, "Universities as the engine of transformational sustainability toward delivering the sustainable development goals: "Living labs" for sustainability," *International Journal of Sustainability in Higher Education* 20, no. 8 (2019): 1343-1357.

[16] Brundiers et al., "Key competencies in sustainability"

[17] Janne J. Salovaara and Katriina Soini, "Educated professionals of sustainability and the dimensions of practices," *International Journal of Sustainability in Higher Education* 22, no. 8 (2021): 69-87.

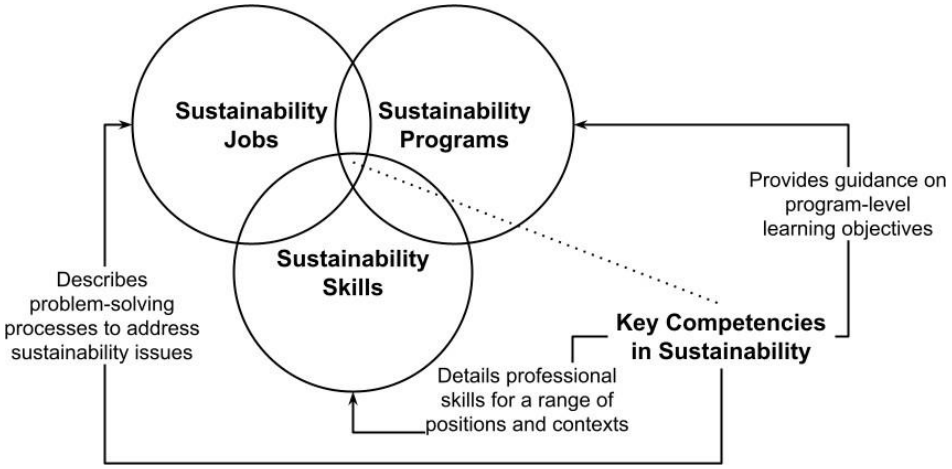
[18] Association for the Advancement of Sustainability in Higher Education, *Academic programs*, AASHE Campus Sustainability Hub, 2023. Shiley Vincent, et al., *Scope of interdisciplinary environmental, sustainability, and energy baccalaureate and graduate education in the United States*, National Council for Science and the Environment, 2017.

[19] David O'Byrne, Weston Dripps, and Kimberly A. Nicholas. "Teaching and learning sustainability: An assessment of the curriculum content and structure of sustainability degree programs in higher education," *Sustainability Science* 10: 43-59.

[20] Christina Kwauk and Olivia Casey. *A new green learning agenda: Approaches to quality education for climate action*, (Center for Universal Education at The Brookings Institution, 2021).

professionals) presents an opportunity to link theory and practice while fostering alignment across the three challenge areas described in this section.

Figure 2: Framework of key competencies in sustainability helping to close the sustainability skills gap



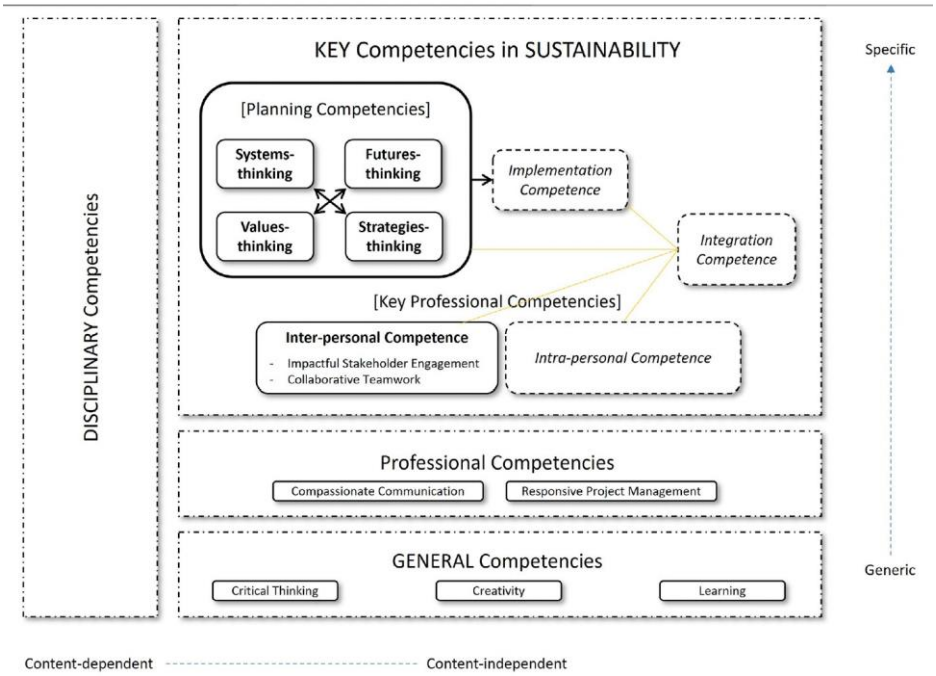
Perspectives on Skills for Sustainability Professionals

The exploration of "sustainability competencies" has been a key focus of sustainability education research and practice in the past two decades. These competencies entail a cluster of related knowledge and skills, as well as motives and attitudes, necessary to successfully accomplish a task in a complex situation by responding to the specific context. A key competency is composed of *several and related competencies* that fulfill similar functions (e.g., constructing scenarios and extrapolating a trend are competencies related to the key competency of "futures thinking" as both fulfill the function of thinking of the future). A key competency enables successful performance across a diversity of contexts. Key competencies in sustainability facilitate achieving successful performance and a positive outcome that progresses sustainability (given what is known, valued, and aspired at a given moment in time), while working on specific sustainability challenges and opportunities in a range of contexts.

The field of sustainability education has a long history of engaging with the questions of how to translate knowledge into action to advance sustainability on the ground. Various sustainability competencies have been presented in the literature since the early 2000s. In 2011, a literature review conducted a first synthesis of this work, which resulted in a framework of key competencies in sustainability that outlined major steps in iterative and collective sustainability problem-solving processes and showed which key competencies in sustainability support which step.[21] Ten years later, another literature review[22] as well as a study with international sustainability experts[23] were undertaken, revealing further convergence around the key competencies in sustainability and highlighting how competency-based approaches can support interdisciplinary teaching and learning that target the sustainability skills gap by addressing four design components (Figure 3): (1) key competencies in sustainability, (2) professional competencies, (3) general competencies, and (4) disciplinary competencies design.

[21] Arnim Wiek, Lauren Withycombe, and Charles L. Redman, "Key competencies in sustainability: A reference framework for academic program development," *Sustainability Science* 6: 203-218.
[22] Redman and Wiek, "Competencies for advancing transformations"
[23] Brundiers et al., "Key competencies in sustainability"

Figure 3: Key competencies in sustainability framework. Figure from Redman and Wiek.



Program-level learning objectives have been proposed for bachelor, master-, and doctoral degree levels.[24] The objectives are supplemented by a "menu" for each key competency that describes its integrated nature of knowledge, skills, and dispositions, as well as its functional contribution to sustainability problem-solving, and related concepts, methods, and tools.[25] Various programs have designed their sustainability programs using the key competencies in sustainability to inform their objectives for graduates (see e.g., programs at Furman University, Arizona State University, Laval University, University of Iceland, Leuphana University). Additionally, pedagogical approaches and assessment techniques for competency development have been developed and evaluated.[26] Thus, experiences on the ground exist and their good practices have been compiled,[27] which helps to facilitate the promotion of skills in academic programs and the design of sustainability programs in higher education.

Building on the work described above, the GCSE SEI has aimed to leverage the KCS framework to support its stakeholders in strengthening the design and evaluation of sustainability programs in higher education as well as how they contribute to the emerging sustainability workforce. Two activities of the GCSE SEI in particular have specifically addressed the sustainability skills gap and how higher education programs can apply the KCS framework

[24] Arnim Wiek, Michael J. Bernstein, Rider W. Foley, Matthew Cohen, Nigel Forrest, Christopher Kuzdas, Braden Kay, and Lauren Withycombe Keeler, "Operationalising competencies in higher education for sustainable development," in *Routledge handbook of higher education for sustainable development*, eds. Matthias Barth, Gerd Michelsen, Marco Rieckmann, and Ian Thomas (Routledge, 2016): 241-260.

[25] Katja Brundiers, Jordan King, Roderic Parnell, and Krista Hiser. *A GCSE proposal statement on key competencies in sustainability: Guidance on the accreditation of sustainability and sustainability-related programs in higher education*. (Global Council for Science and the Environment, 2023).

[26] Jodie Birdman, Arnim Wiek, and Daniel J. Lang "Developing key competencies in sustainability through project-based learning in graduate sustainability programs," *International Journal of Sustainability in Higher Education* 23, no. 5 (2022). Gemma Tejedor et al., "Didactic strategies to promote competencies in sustainability," Sustainability 11, no. 7 (2019): 2086. Aaron Redman, Arnim Wiek, and Matthias Barth. "Current practices of assessing students' sustainability competencies: A review of tools," *Sustainability Science* 16 (2021): 117-135.

[27] Arnim Wiek and Aaron Redman, "What do key competencies in sustainability offer and how to use them," in *Competencies in education for sustainable development*, eds. Paul Vare, Nadia Lausselet, and Marco Rieckmann (Springer, 2022): 27-34.

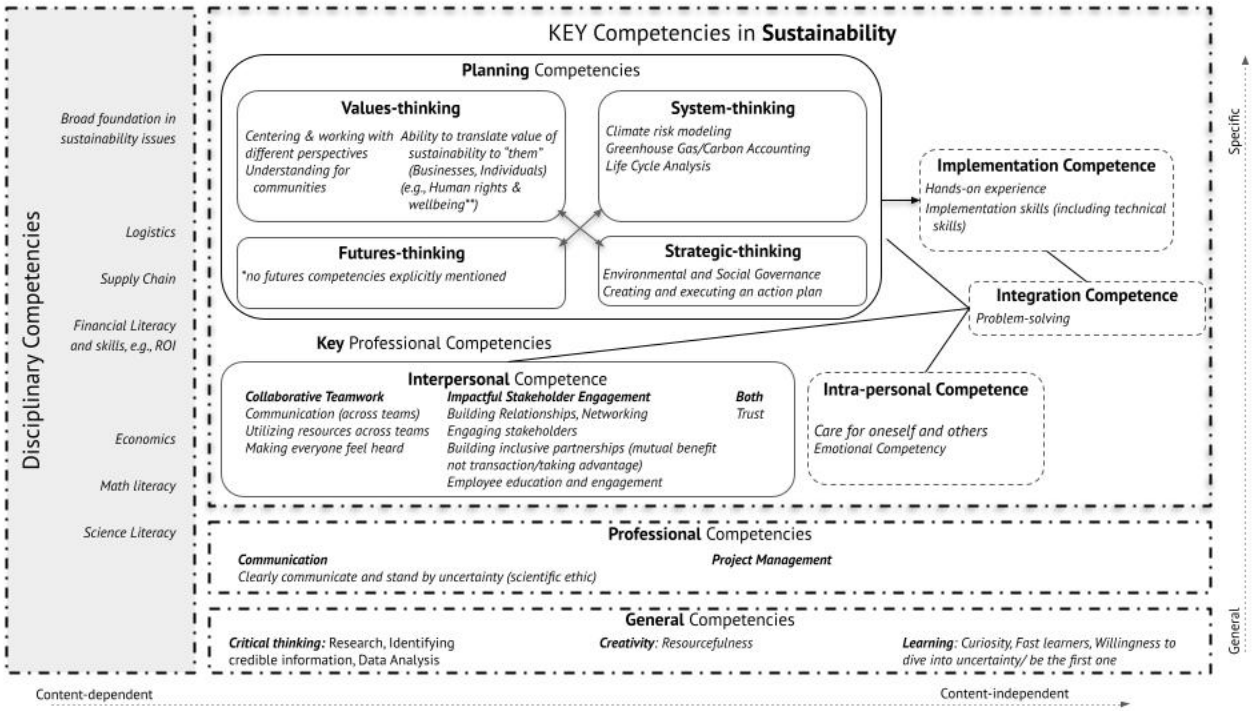
to strengthen student learning experiences and their outcomes. First, we engaged sustainability professionals at the GreenBiz 2023 Conference in Scottsdale, Arizona (an annual gathering of sustainability-minded business leaders) and spoke with former students of sustainability programs and working sustainability professionals in two virtual, public roundtables held in March 2023. We recorded comments from 28 respondents on the question, “what skills, competencies, and/or qualities are most needed in sustainability professionals?” Insights from these responses helped to inform our understanding of the current demand for sustainability professionals and their needed skills, as well as anticipate future workforce needs that can be addressed in higher education programs.

Second, we conducted a broad public input process on a proposal statement describing the KCS framework and its utility for the design and evaluation of sustainability-related programs in higher education. Through a survey, interviews, and discussion sessions with GCSE members and partners we collected feedback on the KCS to further convergence on the framework and support its operationalization in diverse higher education contexts.

Directions towards Closing the Gap

Through a descriptive analysis of the ideas shared by sustainability employers, former students, and working professionals, we stress-tested the KCS framework to examine its alignment with the self-described needs of these workforce stakeholders. We present general outcomes of a basic thematic analysis below. Interpretation of the findings are subject to the limitations of our sampling and methodology. We recognize that these preliminary results depict the perspectives of a small and somewhat homogeneous group that does not fully represent the viewers of the broader sustainability workforce nor entail the comprehensive set of different skills needed for sustainability professionals across positions and contexts. Further investigation of these areas through engagement with more diverse workforce perspectives and the growing literature in this space is needed. However, the insights from our analysis serve the function of affirming the relevance of the KCS framework in describing the necessary skills for a variety of sustainability jobs. Figure 3 organizes the responses we received by their connection to specific design components outlined by Redman and Wiek in the KCS framework.

Figure 3: Analysis of skills, competencies, and qualities needed for sustainability professionals.



Withstanding the variety of language used by workforce stakeholders, the figure demonstrates growing convergence among perspectives and the compatibility between their perspectives and the KCS framework. The primary insights that emerge from this analysis are:

- Certain KCS were often explicitly mentioned by workforce stakeholders as important to their work. These were highlighted by a strong emphasis on the importance of aspects of interpersonal and values-thinking competencies (often related to the need for communication, coordination, and coalition-building across groups), in addition to specific abilities related to systems-thinking (such as life cycle analysis).
- Similar to the structuring of the KCS framework, workforce stakeholders highlighted different design components of the framework as essential to professional practice:
    - Sustainability-specific key competencies, such as those described in the previous bullet point;
    - Professional competencies, such as project management and networking;
    - General academic competencies (that are relevant for all degree programs), such as data analysis skills;
    - Disciplinary competencies and knowledge, such as in areas like business and finance or basic scientific literacy.
- Real-world learning experiences were emphasized as crucial to developing the necessary competencies and being able to translate them from the classroom into application on the job. These experiences were valued for the ways that they facilitated tangible engagement with practical sustainability solutions in interactive settings.

Though a full validation of our results through a comprehensive analysis of the literature in this area is beyond the scope of this paper, we offer one example as a general confirmation of our findings. The 2022 report by Microsoft on “Closing the sustainability skills gap: Helping businesses move from pledges to progress” synthesizes academic and industry literature on green and sustainability jobs along with survey responses from 15 large companies across various sectors. The reports’ findings highlight a variety of connections to the KCS framework, such as the importance of systems-thinking and futures-thinking (which was not specifically mentioned in our responses) as crucial to develop “sustainability fluency” in professionals in the sustainability workforce.[28] Thus, we see additional convergence on the KCS framework as a clarifying lens in examinations of the perspectives of other workforce stakeholders.

The perspectives of higher education stakeholders (including program leaders, faculty, and administrative staff) were gathered in the public input process on GCSE’s *Proposal Statement on Key Competencies in Sustainability*. A preliminary analysis of the feedback received through this process revealed growing agreement on the KCS as an interrelated framework that is relevant as an outline for the necessary abilities for sustainability graduates and how they can contribute to sustainability problem-solving, thus informing the learning objectives of sustainability-related programs in higher education. Broadly, higher education stakeholders emphasized the need for higher education to be responsive to the workforce landscape and evolving job profiles by providing cutting-edge skills that are effective in advancing sustainability solutions. Several other insights from higher education stakeholders complement the workforce perspectives described above by illustrating considerations for higher education programs in preparing students and closing the sustainability skills gap. These primary insights focused on:

- The need for programs to explicitly develop connections between the cross-cutting KCS with professional and general academic competencies, disciplinary knowledge, and specific technical skills to support tangible application in specific contexts.

[28] Microsoft, *Closing the Sustainability Skills Gap*, p.11

- The importance and complexity of values-thinking, particularly the need to be able to negotiate diverse sets of values rather than prescribing certain mindsets in leading change processes.
- The tension inherent in the diversity of the field (in both the range of jobs and types of programs that engage with sustainability) that acts both as a strength and weakness for determining quality standards and developing the necessary competencies in students.

Together, the insights from workforce and higher education stakeholders highlight the value of the KCS framework in facilitating greater alignment between programs and employers on relevant sustainability skills.

Conclusion

In this paper, we have endeavored to describe the work of the GCSE SEI to address the sustainability skills gap by enhancing clarity among the sustainability workforce and sustainability programs in higher education about the sustainability skills that students need to develop as emerging professionals. Our efforts have demonstrated convergence around the KCS framework as a tool for fostering alignment among these areas. More work is needed to further understand what the KCS look like across a range of sustainability jobs and contexts, as well as how they can be operationalized in context-sensitive ways across a variety of higher education programs. We propose several recommendations for how the sustainability workforce, higher education programs, and students as emerging professionals might leverage the KCS framework in better closing the sustainability skills gap.

- Sustainability Workforce: Strengthen communication and collaboration with higher education programs to mutually understand needs and objectives, as well as how they evolve over time.
- Higher Education Programs: Implement professional development opportunities and resources for faculty and program leaders to build capacity in meeting quantity and quality needs in teaching and learning.
- Students as Emerging Professionals: Seek applied and skill-based learning experiences to develop an integrated set of key sustainability competencies, professional competencies, general academic competencies, and disciplinary knowledge.

As a cross-cutting recommendation, we advocate for the development of a flexible and inclusive accreditation approach for sustainability-related programs in higher education. The GCSE SEI has been seeking to co-create such an accreditation process through collaboration with higher education and workforce partners. In addition to advancing greater clarity and alignment between these areas, a voluntary accreditation could establish quality standards for the design and evaluation of sustainability-related programs in higher education, enhancing their effectiveness and accessibility in preparing students with the skills to meet the demands of diverse sustainability jobs. Thus, we see accreditation as an important lever in closing the sustainability skills gap and facilitating broader impact for sustainability.

We recognize that our social structures, economic systems, and higher education itself must transform to ensure a just and sustainable future for all. Thus, making connections between higher education and the sustainability workforce is not a panacea in generating sustainability solutions. Instead, we caution against making this connection without critical examination of the assumptions and aspirations that closing the sustainability skills gap might entail. Yet, we believe that people must have access to education that can help them secure gainful employment that allows them opportunities to contribute to the potential transformations needed in achieving a more just and sustainable future. We propose that using the KCS framework, as developed and affirmed by higher education and workforce communities, can provide a strong but flexible foundation for generating those opportunities.

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