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Building a Community of Practice to Facilitate Integration of Sustainability into Higher Education Curriculum

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Abstract

Directing education for sustainability towards a hopeful future requires coordinated, interdisciplinary approaches. By creating a decentralized, interdisciplinary teaching network at Rose-Hulman Institute of Technology in 2023-24, the three of us supported eighteen faculty participants as they designed sustainability modules for curricula across ten academic departments. This wide range of programs and academic disciplines at a STEM institution indicates a larger campus-wide commitment to sustainability and the potential for broad impact across the student body as materials from the sessions are implemented in 2024-25 and beyond in discipline-specific course content.

Our sustainability-across-the-curriculum network started with foundational concepts of sustainability and sustainable design, a battery of pedagogical tools and techniques, and a menu of local-to-global opportunities for applying sustainability in and beyond our courses, from campus gardens to international travel courses. From our opening workshop to the end of the year, faculty developed course content collaboratively and reflectively. In a series of four working lunches, we shared ideas and practices to support each other through group activities to brainstorm relevant learning opportunities and align course outcomes with established sustainability frameworks such as the UN Sustainable Development Goals and the sustainability competencies model. At the end of the academic year, each participant incorporated sustainability learning strategies into a course of their choice through a variety of approaches, including one-day in-class activities plus follow-up assignments, multi-day course modules, course projects, and lab exercises. Participants shared their work with the campus community at a poster session accompanied by a panel discussion with representatives from other colleges and universities to share strategies, practices, and opportunities for integrating sustainability in and across the curriculum.

As we worked with this community of practice, the three of us investigated ways in which a faculty network might work within a framework that allowed for measured growth in sustainable curricular opportunities for undergraduate students. We collected feedback from participants through surveys conducted at the beginning and end of the academic year. The results show that most participants were interested in learning about what other faculty were doing, continuing their own education overall, and understanding and pursuing sustainability education specifically. Although we faced challenges through this work, creating a supportive, big-tent environment for sharing helped to increase the diversity of perspectives and backgrounds around sustainability and to broaden students' opportunities across the undergraduate STEM curriculum.

1 Background

Suffusing sustainability through the curriculum can be a challenge in engineering education, as it is across higher education. Decisions about what content, principles, tools, competencies, and frameworks will be taught—in which courses at which levels, how and by whom—all constitute one set of difficult tasks for those who hope to see sustainability education as more than just the subject of a course or two that may or may not be required. While they can be made more manageable with support and/or pressure from administrations committed to curricular change, these tasks are much harder for faculty who seek to deepen and broaden students' learning about sustainability without an institutional mandate. Like many of our peers in higher education, we have found that a faculty teaching network can be a helpful way to incentivize, support, and arrange for the growth of sustainability in the curriculum.

Weiss, Barth, and von Wehrden (2021) have identified patterns by which sustainability programs and curricula are implemented, considering elements such as disciplinarity and depth as well as drivers and impediments to curricular change. Common patterns include a fully formalized “collaborative paradigm” involving an entire educational institution, “top-down, mandated institutional change” driven by university leaders, and “externally driven initiatives” “characterized by weak internal support and planning and a strong external driver.” Faculty-led initiatives, on the other hand, are characterized as “bottom-up, evolving institutional change” with “knowledge exchange through informal communicative arenas (e.g., a communities-of-practice approach, digital exchange, and a learning platform),” though such bottom-up initiatives threaten to become isolated initiatives if they fail to find institutional support (see also Ferren, Dolinsky, and McCambly [2015]). By contrast, Brinkhurst et al. (2011) locate faculty and staff sustainability efforts not as “bottom-up,” but as “middle-out change,” which require support from the bottom as well as the top, but nevertheless contain “the greatest potential for long-term change.”

According to Barlett and Rappaport (2009), research on faculty development programs in sustainability has shown “surprisingly robust effects on university life and faculty members' work,” including “new interdisciplinary research, grants, and publications; expanded knowledge and practical action; and strengthened collegial community connections with the natural world.” Together with Geoff Chase, Peggy Barlett's work with faculty development has been instrumental in developing two decades' worth of Sustainability Across the Curriculum workshops run by the Association for the Advancement of Sustainability in Higher Education (AASHE), which two of the us (Mueller and Minster) attended (Barlett and Chase 2004). Sustainability teaching workshops and networks like these are grounded in a communities of practice approach, with networks providing more opportunity for development over time (Wenger 1998).

2 Our Approach

The purpose of our Sustainability Teaching Network (STN) was to provide a community of practice for participating faculty to support their development of sustainability content within their discipline-specific course of their choosing. In doing so, we investigated the question, “In what ways does a faculty network provide a supportive framework for curricular development of sustainability content and therefore measured growth in curricular opportunities for undergraduate students?”

Our inaugural STN encompassed the full duration of Academic Year (AY) 2023-24. Through this collaborative network, each participant developed course content integrating sustainability into a discipline-specific course of their choice. That content could be a one-day in-class activity and follow-up assignment, a multi-day course module, a course project, a lab exercise, a research essay, or any other content that is relevant to integrate sustainability into your course. We started the STN with a full-day workshop, where we covered foundational concepts in sustainability and sustainable design, tools for applying these into discipline-specific coursework, and assessment practices for measuring student capacity by aligning course content with established sustainability frameworks, primarily the United Nations Sustainable Development Goals (UNSDGs; UN 2015) and Engineering for One Planet (EOP; Lemelson Foundation 2022).

The full-day workshop was bolstered by four working lunches offered during the academic year which brought together the participating faculty and the three faculty network leaders and focused on information sharing, content discussion, and group activities for course development. Sharing pedagogical practices helped to support each other in developing relevant course content. These group lunches were further supported by one-on-one meetings between participants and network leaders to support more in-depth development of sustainability course content between scheduled group working lunches. These one-on-one sessions helped to deepen the engagement and individualization of the STN sessions by ensuring that all participants were able to uniquely engage the material and think through the lessons in a manner relevant to their coursework and degree program.

The STN programming offered throughout AY2023-24 concluded with a panel discussion and poster session, with 15 total participants in the STN presenting their course content to the campus community and invited panelists. The four invited panelists who joined for the panel discussion were representatives from other regional institutions of higher education to share strategies, practices, and opportunities for integrating sustainability in education. Over the course of the inaugural STN cohort, 18 faculty members (composed of three leaders and 15 participants) took part in the workshop and lunches. The faculty participants represented 10 academic departments, including Biology and Biomedical Engineering; Mathematics; Chemistry; Civil Engineering; Chemical Engineering; Engineering Management; Mechanical Engineering; Humanities, Social Sciences, and the Arts; Engineering Design; and Physics and Optical Engineering. This range of degree program engagement represented a core goal of the STN in bringing together a wide range of academic disciplines to indicate a campus-wide commitment around sustainability and a broad impact across the student body as the content developed through the STN sessions were implemented in coursework. The second STN cohort in AY 2024-25 brought in six new participants representing departments of Chemical Engineering; Mathematics; Mechanical Engineering; and Humanities, Social Sciences, and the Arts. The six participants were paired with mentors from the previous year's cohort. These mentors provided support through one-on-one meetings with their paired mentee, as well as through discussions at the workshop and network lunch meetings.

3 Results and Interpretation

During the initial workshop in both AY2023-24 and AY2024-25, new cohort participants completed a pre-work survey to better understand what they hoped to gain through their participation in the network. We followed with a post-work survey at the end of each AY to better understand the ways in which a faculty

network provides a supportive framework for curricular development of sustainability content; and therefore, measured growth in curricular opportunities for undergraduate students.

The pre-work survey results showed more than 70% of participants (n=17) are interested in examples of how other faculty are utilizing sustainability content in their courses, have a desire to pursue sustainable education, had an interest in continuing education opportunity, and had a desire to better understand sustainable education from others who have more experience in that area (Table 1). In addition to the strong association with a deeper understanding for content and implementation strategies, our participants indicated an interest in growing their network. Additionally, participants were interested in the development of new content rather than refreshing outdated content (Table 1).

Table 1: Reasons individuals identified for participation in the STN (n=17)

Statement	Percent Agree
I am interested in sustainability content other faculty are generating in their courses.	88%
I have wanted to participate in sustainability education for a while now and this provides me with an opportunity to get started.	77%
I see this as a continuing education opportunity which I think is important for faculty growth and development.	71%
I am interested in learning more about sustainability concepts and pedagogy from those with classroom experience.	71%
I want to grow my network.	59%
I appreciate the modest financial compensation.	47%
I have been using the same assignments in my sustainability-themed course and this opportunity makes it feasible for me to consider new assignments for my course.	18%

Many participants were also interested in learning about broader themes and principles of sustainability (Table 2). While some participants indicated the use of sustainability themes in their courses (Table 5), less than 60% of participants currently taught any listed theme in their courses with one participant responding none of the themes listed were currently taught. Furthermore, more than 70% of participants indicated the desire to learn more about topics of sustainability metrics, renewable energy technologies, and climate science (Table 5).

Table 2: Aspects about which participants want to learn more (n=17)

Statement	Percent Agree
Pedagogies, concepts, themes, and tools other faculty are implementing in their courses.	77%
Specific sustainability metrics and techniques (such as Life Cycle Analysis, etc).	71%
Knowledge and awareness of core sustainability content (climate science, ecosystem dynamics, social justice, etc),	71%

How we define “sustainability” at Rose-Hulman.	71%
General sustainability themes such as UNSDGs and methods to incorporate those themes into my course(s).	65%
Broader pedagogical themes such as systems thinking and service learning.	65%

To compare interests and expectations from the beginning our community of practice with STN feedback at the end of each AY, we asked participants to respond to a post-work survey, indicating how participation in the STN led to advancements related to network participation and sustainability in education, an increased understanding in sustainability themes, and a plan to use sustainability themes in one or more of my course(s). Most aligned with our purpose of fostering this community of practice, the majority of participants noted an increased confidence to incorporate sustainability in their courses and a better understanding of sustainability content (Table 3). Furthermore, a growth in their professional network and a better understanding of how colleagues are incorporating sustainability in courses was prominent among participants (Table 3).

Table 3: Themes about which participants attribute to their participation in the STN (n=12)

Statement	Percent Agree
Professional network growth	92%
Increased understanding of how my colleagues across disciplines incorporate sustainability in their courses	92%
Increased confidence to incorporate sustainability into my courses	83%
A better understanding of sustainability content	83%
An opportunity to enhance my courses and teaching	83%
Increased understanding of pedagogical techniques	33%

Primary focal points of our community of practice meetings including aligning sustainability course work being developed with established frameworks (e.g. UNSDGs and EOP). Most participants noted they had better understanding of the UNSDGs and awareness of sustainability content (Table 4). Due to the collaborative nature of this network environment, participants also indicated a broader knowledge of how colleagues were implementing sustainability themes in their courses (Table 4).

Table 4: Key learning areas related to sustainability in education about which participants attribute to their participation in the STN (n=12)

Statement	Percent Agree
A better understanding of the UNSDGs and methods to incorporate those themes into my course(s)	83%
A broader understanding of pedagogies, concepts, themes, and tools other faculty are implementing in their courses	75%
A better understanding of how we define "sustainability" at Rose-Hulman	75%
Knowledge and awareness of core sustainability content (climate science, ecosystem dynamics, social justice, etc)	58%

A better understanding of specific sustainability metrics and techniques (such as Life Cycle Analysis, etc)	42%
A better understanding of broader pedagogical themes such as systems thinking and service learning	17%

We wanted to determine what content areas were of most interest to network participants to help our focus of future “deeper dive” workshops. While certain themes (e.g. sustainability metrics, UNSDGs) had proportionally high implementation, other themes (e.g. climate science, circular economy, and renewable energy technologies) show opportunities for growth based on faculty interest. While not all themes might be equally applicable to all disciplines, Table 5 denotes an overall desire to grow participant’s knowledge and awareness of these themes collectively.

Table 5: Sustainability themes that participants indicated they plan to use in their course(s)

	Pre-work Survey: Interest levels in sustainability themes (n=17)	Pre-work Survey: Themes currently used in participants' courses (n=17)	Post-work Survey: Sustainability themes of which the STN led to an increased understanding (n=12)	Post-work Survey: Sustainability themes participants plan to use in their course(s) (n=12)
Circular Economy	53%	29%	33%	17%
Climate Science	71%	29%	25%	17%
Ecosystem Dynamics	35%	12%	8%	0%
Engineering for One Planet Framework	NA	NA	58%	33%
Lean Manufacturing	24%	18%	0%	0%
Models for Defining Sustainability/Sustainable Development	NA	NA	42%	42%
Renewable Energy Technology	77%	59%	17%	25%
Service Learning	35%	12%	0%	0%
Social Justice	NA	6%	25%	25%
Sustainability Metrics (Carbon Footprint, Life Cycle Analysis, Water Footprint)	88%	47%	83%	75%
Sustainable Chemistry and Engineering	47%	24%	25%	25%
Systems Thinking	47%	35%	33%	25%
United Nations Sustainable Development Goals	59%	35%	67%	75%

4 Discussion

Though our data set is small, our experience beginning a faculty sustainability network corroborates several important takeaways from the literature on sustainability education. While Barlett and Rappaport discuss how many faculty say their teaching and knowledge about sustainability changed as a result of the teaching network, and Natkin and Kolbe (2016) show that the actual curricular impact of faculty learning communities may be modest, our experience shows, first, that participants in a community of practice dedicated to sustainability frameworks see it as a value in and of itself.

In their book chapter, “Faculty Empowerment in the Sustainability Education Transition,” Jordi Segalas and Gemma Tejedor (2025) claim that “faculty attitude, engagement, empowerment processes and capability development and training are critical to the successful introduction and development of sustainability education.” They helpfully categorize faculty by attitude and ability, grouping them into (a) those who would commit to education for sustainability even without support; (b) the “skeptics,” who are unlikely to participate no matter what; (3) those with “high attitude and low ability,” for whom the right strategy is to “facilitate,” with opportunities for collaboration, as well as (4) those with low attitude and high ability, for whom the strategy is to “incentivize,” including faculty training and funding. Our STN cohort included a mix of groups (1), (3), and (4), which fits an institution led primarily from the middle out. Thus, even if changes to the curriculum are modest at the beginning, faculty experiences of empowerment and capacity building lay the groundwork for changes to come.

Second, because our community is deeply interdisciplinary, we have found that our insistence on sustainability frameworks rather than specific definitions—what Natkin and Kolbe (2016) call “the sustainability buffet”—empowers participants to see their work as both discipline-specific and coordinated with peers’ efforts in other disciplines. While Segalas and Tejedor (2025) argue for the importance of having a shared definition of sustainability, our experience suggests that sharing definition matters less than sharing frameworks. The UN SDGs (UN 2015, Hong 2020), the Engineering for One Planet Framework (Lemelson 2022) and the sustainability competencies (Redman and Wiek 2021) all allow a variety of definitions (e.g., sustainability as carrying capacity, sustainability as more equitable global development, sustainability as an ethical orientation opposed to cost-benefit analysis) without diluting sustainability concepts or privileging one discipline over others (Reid and Petocz 2006).

Finally, the literature on communities of practice suggests strongly that teaching networks like ours are most impactful the longer they last (Wenger et al. 2011, Steinert et al. 2006, Abigail 2016). Thankfully, as Rutz et al. (2012) have observed, faculty networks with strong social cohesion “can persist over time, even when funding is exhausted.” It is “informal webs of relationships” that can make a difference in “how well and quickly change efforts take hold, diffuse, and sustain” (Daly 2010). As we write, we look forward to the second year of our Sustainability Teaching Network, with six first-year participants returning as mentors for the second cohort.

5 References

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