# Disrupting the Curriculum: Leveraging the Engineering for One Planet Framework to (re)Center Sustainability in Engineering Education

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## Abstract

To catalyze curricular transformation and thus the training and practice of engineering, we proposed the creation of an Engineering for Sustainable Development specialization within the Department of Food, Agricultural and Biological Engineering incorporates learning outcomes from the Engineering for One Planet framework. These efforts served to help institutionalize the ongoing sustainable engineering instruction at The Ohio State University in a meaningful way.

Currently, engineering students at OSU do not have a formal pathway or structure to engage with sustainability-related, community-engaged content. While culturally competent sustainability focused coursework may be obtained piecemeal, it is certainly not universally accessible as a primary focus to engineering students with tight degree plan requirements within their majors.

The proposed specialization is an important long-term programmatic creation effort to advance sustainability education within engineering. The department chair has supported a multi-year effort to support and create student-centric community-engaged learning opportunities. This department driven (top-down) effort is also supported at college level by the Associate Dean and Director for Academic Programs in the College of Food, Agricultural and Environmental Sciences.

The Engineering for One Planet Mini-Grant resources were to develop General Education course offerings within the Sustainability theme as well as technical electives that promote social responsibility. Course creation and revisions incorporated EOP learning outcomes; many of these revisions took effect in Autumn 2023. Additionally, one of the core courses of our proposed specialization will be offered on a satellite campus beginning Spring 2024.

The EOP framework provided the guiding principles for the proposed specialization. These programmatic elements balance student learning with community impacts while weaving Sustainability, Intercultural Competence and Cultural Awareness into a core tenet of engineering. Further, the EOP mentorship program was instrumental in guiding the project participants in creating buy-in from stakeholders across the university enterprise.


## Introduction

There are many dimensions to sustainability, and our pedagogical approach to sustainability curricula requires the continuous evolution of engineering education. In the systems-thinking context, sustainability requires us to recognize differing lived experiences, perspectives, and cultures as crucial factors in how we view and interact with our interconnected world. Within the current global landscape, disparate environmental impact often arises from existing power differentials and societal structural elements; therefore, these factors are paramount design factors. More simply, sustainability is the consideration of the relationships and limitations of economic, environmental, and social factors for all stakeholders in both engineering training and practice.

Many of the most urgent and severe global challenges, from adapting to and mitigating climate change, and providing safe and accessible water, demand that the next generation of scientists and engineers think about and solve problems in novel ways. This requires a review of how engineering courses and programs are currently preparing students for the globalizing workforce [1]-[3]. These challenges, known as wicked problems, are complex issues without clear boundaries and are driven by stakeholders' differing values, interests, and conceptions of the problem and its solution [4]. They are also inherently about sustainability.

To better equip the STEM workforce to tackle wicked problems, students must link multidisciplinary perspectives from the social sciences to critical design skills [5]. In addition, the development of cultural competencies with strong interpersonal and professional skills will be critical to challenge the complexities of these issues from a wide range of perspectives and skillsets [6]. Intercultural Competence is the lifelong process of developing targeted knowledge, skills, and attitudes leading to behaviors and communication that are both effective and appropriate in intercultural interactions [7]. There is clearly a need to incorporate elements of social responsibility through stakeholder understanding into engineering design and practice. This empathic dimension will not only strengthen the professional skill set of graduates through increasing their intercultural competence, but also attract STEM undergraduates.

Within the College of Engineering, the Humanitarian Engineering Program aims to educate students on the application of science and engineering to address complex societal challenges with an emphasis on collaborating with communities to achieve their desired vision of well-being. The curriculum is grounded in theories of sustainable development, applied engineering, and socio-cultural learning experiences. Interdisciplinary partnerships were formed across the University to encourage the inclusion of transdisciplinary approaches into courses offered to engineering students through the HE minor. With over 50 students currently enrolled in the Humanitarian Engineering minor, strong interest exists for sustainability-centric engagement opportunities within the Department of Food, Agricultural and Biological Engineering at the Undergraduate and Graduate level.

*Engineering for Sustainable Development*

Over the last twenty years, the Engineering for Sustainable Development field has been growing across the academic domain [8]. A growing number of colleges and universities have made it an institutional priority to create learning opportunities to engage students in local and global diversity [9]. Employers also increasingly value intercultural knowledge and global competence in college graduates according to the report Fulfilling the American Dreams: Liberal Education and the Future of Work [10]. The report concludes that since 2014 employers put more emphasis on the ability to collaborate in diverse teams and solve problems from multiple perspectives. These trends prompted a re-examination on how engineering curricula prepare students with necessary skills and competencies that go beyond the technical skills [2]. Overall, there has been a growing interest in integrating intercultural learning and diversity education in engineering programs in conjunction with experiential and collaborative learning.

Engineering for Sustainable Development (ESD) involves the integration of social, environmental, and economic factors with the application of engineering principles to address

complex real-world challenges. Currently, the HE minor emphasizes collaborating with communities and understanding stakeholder values to address sustainability challenges. The proposed ESD specialization includes instruction about intercultural competence, but also infuses and explicitly articulates sustainability concepts into engineering education to prepare students to address complex global sustainability challenges. Within the HE minor and the courses included in the proposed ESD specialization, we use the Intercultural Development Inventory® to assess intercultural competence.

*Project Objective*

To catalyze curricular transformation and thus the training and practice of engineering at our institution, we proposed the creation of an Engineering for Sustainable Development specialization within the Department of Food, Agricultural and Biological Engineering (FABE) that incorporates learning outcomes across several categories and topics present as articulated by the EOP framework [11]. This program would build upon existing curricular elements within the HE minor.

*Project Team and Institutional Climate*

The project team consists of interdisciplinary partners that possess the required expertise to successfully implement and pursue these activities. Their complementary skillsets cover engineering education, intercultural competence, social and environmental interactions and humanitarian engineering, water resources engineering, and agricultural and biological engineering. Team members have regularly received training and engaged with diversity and inclusion efforts at the College and University levels, such as the Diversity and Inclusion Excellence Certificate Program. Members have also undertaken instruction training and received endorsements through OSU's Drake Institute for Teaching and Learning to create and sustain educational environments that intentionally value inclusive excellence and advance equity.

A key goal is to improve the negative climate culture that is often linked to the STEM fields and the lack of representation. Through instruction design and culturally responsive pedagogy, our team creates learning environments that value diverse viewpoints and representation to teaching students to approach problem solving in a collaborative and culturally relevant way.

At the Institutional level, OSU's Shared Values speak to our mission as a community-engaged land grant university. Many initiatives reflect the commitment to justice, equity, diversity, and inclusion. Notable and relevant examples include: the President and Provost's Council on Sustainability, which advises on sustainable practices across the university enterprise; the Task Force on Racism and Racial Inequities, which issued its report in April 2022; and the RAISE Initiative, which aimed to hire full-time faculty whose research focuses on racial inequities.

In recognition of the importance of sustainability and sustainability education, OSU developed a framework that not only supports existing curricula but also encourages innovative new programs of study that span across and between academic units. This framework includes six dimensions of sustainability and represents a coordinated effort to imbue all students with a robust sustainability education. We sought to integrate these dimensions into existing courses while also proposing new courses for development and inclusion into curricular pathways.

Within the College of Engineering, the Humanitarian Engineering minor aims to educate students on the application of science and engineering to address complex societal challenges with an emphasis on collaborating with communities to achieve their desired vision of well-being through a curriculum grounded in proven theories of sustainable development, applied engineering, and socio-cultural learning experiences. Interdisciplinary partnerships have been formed across the University to encourage the inclusion of transdisciplinary approaches into courses offered to engineering students.

Additionally, the Sustainability Institute at OSU seeks to provide leadership, coordination, and support for sustainability education and engagement across all academic units and operations. This includes support for the development of sustainability education programs.

**EOP Framework Integration**

*Specialization Proposal*

We recognized the need to create formal pathways and structure for engineering students to engage with sustainability-related, socially responsible, and community-engaged content. While culturally competent sustainability focused coursework may be obtained piecemeal, it is not as broadly accessible to engineering students with tight degree plan requirements within their majors. FABE was the natural platform given that many of the existing courses in the Humanitarian Engineering minor were developed and are currently taught by personnel in our department. After engaging in formal and informal activities to build interest and support, a proposal was developed and presented to the Academic Affairs Committee and is slated for approval within the next few months.

The proposed course creation and revisions incorporated learning outcomes spanning several topics within the EOP framework, including Design, Critical Thinking, Social Responsibility, Communication and Teamwork, and Environmental Literacy. The EOP framework provided the guiding principles as we developed and modified curriculum for inclusion in the Engineering for Sustainable Development specialization. We sought to create programmatic elements that balance student learning with community impacts while weaving Sustainability, Intercultural Competence and Cultural Awareness into a core tenet of engineering instead of siloed concepts.

*Mapping EOP to Current Learning Outcomes and Ohio State's Sustainability Education Framework*

In 2019, The Sustainability Institute presented "Recommendations for Undergraduate Sustainability Education at Ohio State" This conceptual framework details six thematic dimensions of sustainability education. Our department has existing curricular elements that align with each of these themes. Thus, the potential for relevant sustainability course development is great. Through the EOP MGP, we sought to harmonize the OSUs Sustainability Education Framework with EOP (Figure 1).

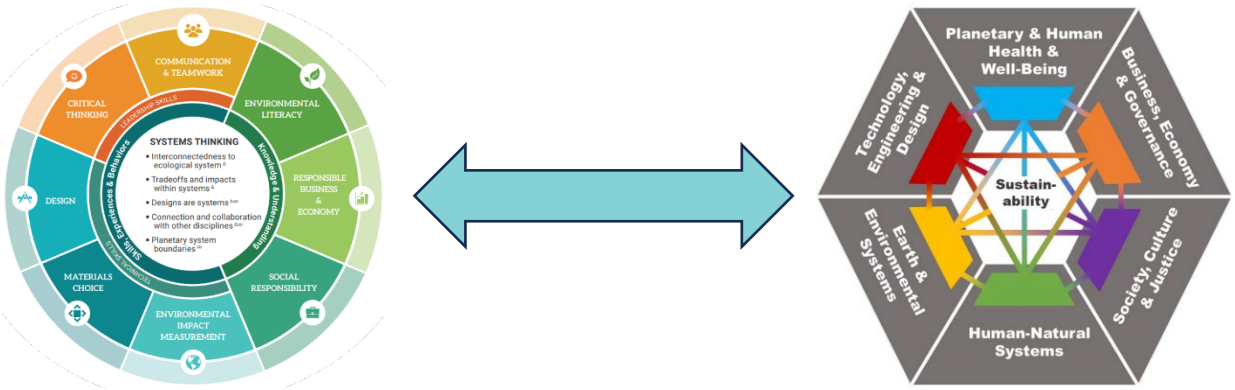



Figure 1. Mapping EOP Framework to OSU's Sustainability Framework.

Next, we examined our proposed specialization core courses, specifically the student learning objectives, for alignment with the EOP framework (Figure 2). We evaluated areas of current alignment, wherein we could revise/clarify to highlight sustainability-centric content. Further, we identified opportunities for additional content and focus.

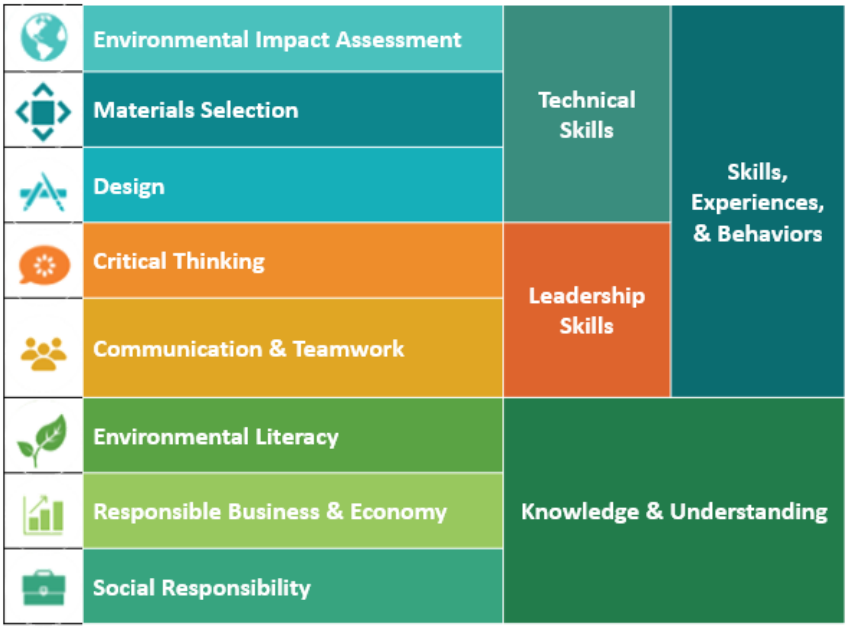



Figure 3 (left). Legend of EOP topics, subcategories, and categories, moving from left to right. *Systems Thinking (omitted) is a fundamental concept in the framework as a topic/category that encompasses all other categories and topics.

Figure 4 (below). Strengths and Opportunities of the proposed ESD curriculum in alignment with the EOP framework.

| Course | EOP – Current Alignment | EOP – (Gaps) |
|---|---|---|
| Intro to Humanitarian Engineering | | |
| WasH | | |
| SWoT | | |
| Wicked Science | | |
| Global Design Capstone (I/II) | | |

*Revised Student Learning Objectives and Coursework*
During the MGP, several courses were modified to bring closer or more explicit alignment with the EOP framework.

Table 1. Revisions to Existing Curriculum

| | |
|---|---|
| Global Capstone I<br>Global Capstone II | • formal presentation of EOP framework<br>• inclusion of sustainability consideration and content during design process<br>• EOP-themed metrics required for the Technical Report<br>• reflection activities about various sustainability topics |
| Sustainable Infrastructure for Rural Developing Communities | • formal presentation of EOP framework, with accompanying reflections<br>• assignment using the EOP framework critically to evaluate a WaSH intervention and implementation<br>• learning outcomes re-articulated to reflect sustainability-centric verbiage |
| Safe Water on Tap | • formal presentation of EOP framework<br>• assignment using the EOP framework critically to review the syllabus for areas of synergy<br>• learning outcomes re-articulated to reflect sustainability-centric verbiage<br>• reflection activities about sustainability |
| Sustainable and Resilient Communities – Tanzania | • EOP Framework was used to align and center sustainability considerations with particular emphasis on leadership and behaviors as students were prepared for cross-cultural immersion<br>• reflection activities to consider how embodiment of sustainability ideals and actions may differ across cultures and lived experiences |
| Introduction to Humanitarian Engineering (Lecture and Lab sections) | • formal presentation on EOP<br>• course activity wherein students critically review the syllabus for alignment with EOP framework<br>• addition of sustainability-centric verbiage in the learning outcomes<br>• reflection activities about sustainability<br>• content about stakeholder dynamics, indigenous ways of knowing; the history of the UN's definition of sustainability and SDGs |

*Development of New Courses*
Additionally, two courses were developed using learning outcomes from the EOP framework.

Engineering in Context: Honduras launched in Spring 2024. This community-based course connects the themes of innovation, community building, culture, society, and water infrastructure in the context of the majority world. The goal of the course is to offer students an experiential learning experience, collaborating with partners AguaClara Reach, Agua Para El Pueblo, and other civil society organizations in emerging markets and economically disadvantaged communities. Students will learn about the challenges and opportunities of creating sustainable infrastructure, institutional networks, and technical backstopping for water, sanitation, and

hygiene. During the spring semester, students read about development theory and the social, political, and historical context of Honduras and students synthesize the readings and observations to develop a clearer understanding of the challenges of cross-cultural collaboration design. Technical engineering concepts applied with the societal and contextual elements help students envision how to deliver sustainable and equitable access to clean water, which is a fundamental human right. During the travel portion intersession, students travel to Honduras for an intensive engineering in context experience.

Revision to this course included a formal presentation on EOP, and various reflection activities about sustainability.

Environmental Sustainability and Social Responsibility in Engineering, Science, and Technology is pending approval. This course invites students to explore the intersection(s) between engineering, technology, science, the environment, human health and welfare, and social justice. Students will critically examine how the practice and application of engineering solutions can contribute to (and potentially alleviate) societal inequality, thus affecting the resilience and sustainability of our ecosystem. Students will undertake a rigorous examination of circumstances outside of their lived experiences in relation to the natural environment. This course will be submitted for approval as a General Education course in the Sustainability Theme.

Additions to the proposed syllabus included: a formal presentation on EOP; Student Learning Outcomes (SLO) to understand the power of diversity and broad(er) participation in the pursuit of sustainability; SLO to articulate various definitions of justice (environmental, ecological, engineering) and how they relate to sustainability; reflection activities about sustainability.

Buckeye PreCollege Institute Course: Impact Engineering, Technology, and Science for Solving Wicked Problems was an unexpected opportunity for outreach to high school students. While not a non-credit course, we invited high school students to become wicked engineers and scientists who can tackle grand challenges, which are inherently global sustainability challenges. This course invited students to explore how engineering, technology, and science intersect with the environment, human health and welfare, and social justice. Students also critically examined how the practice and application of sustainable engineering solutions contributes to (and potentially alleviates) societal inequality. This course also introduced students to the field of Humanitarian Engineering, which emphasizes the societal dimensions of contemporary engineering. Students expand their professional skillsets by engaging in self-reflection and dialogue about intercultural considerations for tackling wicked problems. Thus, students rigorously examine multicultural circumstances outside of their lived experiences. Students also explore potential STEM career paths that address disparate effects on minoritized or underserved communities.

Additions to the two-week curriculum included: specific learning outcomes to increase environmental literacy and comprehension of sustainability concepts; a formal presentation on EOP; multiple reflection assignments; rigorous exploration of the UN's SDGs.

**ESD Specialization Components**

*Undergraduate Curriculum*

The proposed specialization is an important effort to complement the existing sustainability curriculum. A curricular basis has already been established, with the encouragement of the department chair, as many of the existing courses in the Humanitarian Engineering minor were developed and are currently taught by FABE personnel. This department driven (top-down) effort is also supported at college level by the current Associate Dean and Director for Academic Programs in the College of Food, Agriculture and Environmental Sciences and Professor of Engineering Education. This specialization will be unique to FABE and differentiated from the HE minor by an explicit emphasis on sustainability engineering and development.

Core and elective courses in ESD will incorporate learning outcomes which span several thematic dimensions within OSU's Sustainability Education Framework, and well as several sustainability-focused topics from the EOP framework. Considering the new General Education Structure, launched in Fall 2022, there are many opportunities to restructure existing courses to satisfy the learning outcomes for several theme areas such as Citizenship for a Diverse and Just World, Lived Environments, and Sustainability. Further, there are opportunities to offer/develop courses that include Integrative Practices or High-Impact Practices, which are already incorporated into several of the existing HE minor courses. This lowers the participation barrier by allowing students to meet GE requirements while also completing the ESD specialization.

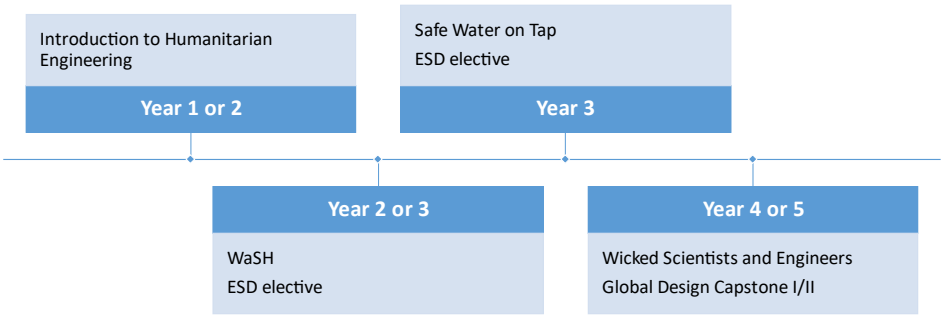



Figure 4. Sample Progression for an ESD student.

The degree plan for ESD includes 16 credit hours in the specialization core, 9 credit hours of specialization electives, and maintains core requirements for both the College of Engineering and FABE. Total hours to complete the degree program remains at 132 credit hours, in alignment with the department's other specialization curricula.

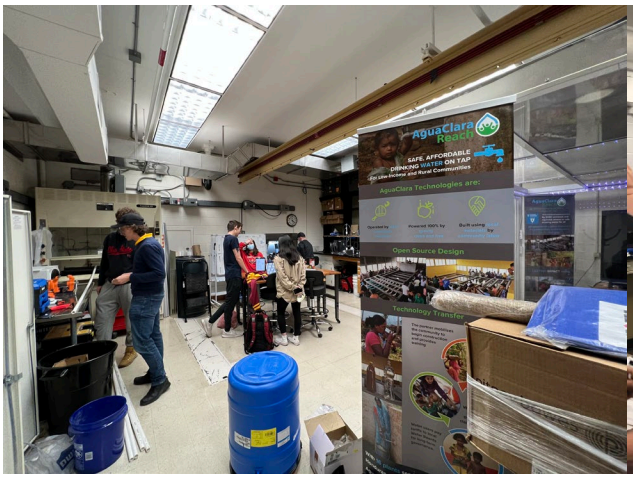
*Undergraduate Research*

Given that the strenuous and overcrowded academic degree requirements of engineering students often limits the ability for research engagement outside of their strict curricula, the ESD program is founded on community-engaged student research as a central tenet. While engagement within this realm has been demonstrated to positively impact students cognitive and affective abilities, there are still limited opportunities for hands-on exploration that does not utilize partners and communities as experimental technical oriented solution testing grounds. Previously, the Humanitarian Engineering program lacked on-campus presence as well as the physical lab space

required to experience hands-on prototyping aimed at building conceptual understanding as projects shift from ideas to realization.

In response, a makerspace-style lab was established in early 2021: a communal lab space available to provide experiential learning opportunities to develop and work directly with sustainable technologies and community development efforts, while also building community across the various entities. In addition to exposing students to the skills, materials, and techniques associated with the global challenges in sustainable development, another aspiration was to provide collaboration space to foster an inclusive environment.

From the humble beginnings of an abandoned cleanroom (Figure 5), the Impact Engineering Lab serves student groups and course projects from across the academic landscape and provided an informal “home” for what would become ESD. Fortunately, this success has bred the need for expanded capacity and space. The new space (Figures 6 and 7) currently supports 12 courses, four student organizations, undergraduate and graduate research culminating to engage over 350 students. Further, the lab space has supported a broader effort to provide engaged opportunities across an array of experiences, thus reducing barrier student participation.



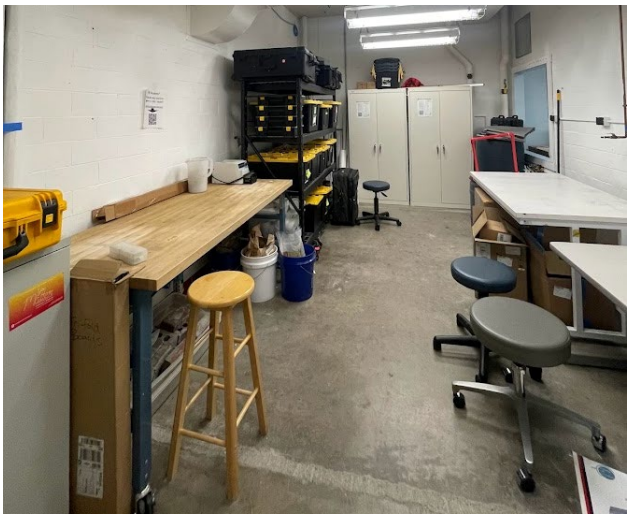



Figure 5 (upper left). Previous home of the Impact Engineering Lab/Makerspace.

Figure 6 (upper right). Prototyping and research stations, including lab space for the Introduction to Humanitarian Engineering and Global Capstone courses.

Figure 7 (right). Workshop and storage room.

The value of ESD research and learning opportunities to both internal and external partners cannot be sustainably demonstrated and communicated through piecemeal funding and resources. Recognition of this lab under the proposed structure of an ESD program, would open avenues for larger funding opportunities to not only continue support for the undergraduate research that has already been established, but also provide expanded opportunities for sustainability engineering research.

*Community-Engaged Learning Opportunities*

Driven by the globalizing world and the complex issues that require these robust skillsets, Universities across the higher education landscape have developed community-oriented programs where students engage in service-related activities that aim to address community perceived needs while achieving educational goals. These programs are known as Service Learning, Community Engaged Learning (CEL), and/or Global Service Learning (GSL) [12]. The need to balance the outcomes between the communities and the students has been noted a key consideration when designing programs. As well as the importance of embedded reflection opportunities to foster critical development of students' understanding of the social structures and contextual elements present within the communities with which they are engaging [13]. Our community engaged learning opportunities are curated with long term partnerships based around external University partners and international NGOs. These programs are structured to provide students meaningful intercultural and cross-cultural experience while aiming to center community power dynamics.

*Collaborative Online International Learning (COIL)*

We are engaged in pedagogy to make learning more accessible. Collaborative Online International Learning and Virtual Exchange (COIL/VE) has emerged as a new teaching and learning paradigm that promotes global learning and development of intercultural competence across shared multicultural learning environments [14]. COIL/VE has become a strategic priority in OSU's most recent strategic plan for comprehensive internationalization. Using technology and innovative online pedagogies, COIL/VE fosters meaningful interactions between instructors and students from diverse cultural backgrounds. COIL/VE is also known as an innovative, cost-effective instructional method that combines experiential cross-cultural learning and collaborative learning within the context of course instruction [15].

The ESD program will include existing and proposed/redesigned courses that employ COIL/VE because it provides more equitable access to global learning experience, particularly underserved and underrepresented (historically systematically excluded) students who may have not been able to previously participate. While the culturally responsive pedagogies that are typically adopted in COIL courses tend to focus on the learning outcomes rather than simulating activities and itineraries, they also make the content more accessible. In addition to international partnerships, this format allows students to participate from regional campuses or other interested institutions. Specifically, there has been interest from Central State University's International Center for Water Resources Management for their students to have access to these types of opportunities. The potential to establish meaningful relationships with HBCU's and other MSI's cannot be discounted.

**Impact**

Specifically, the resources of the EOP mini-grant program were used to further development of General Education course offerings within the Sustainability theme as well as technical electives that promote sustainability and social responsibility. This aided our efforts to institutionalize the ongoing sustainable engineering instruction in a meaningful way. For those interested in integrating the EOP framework, the authors suggest utilizing the broad array of course resources and lesson plans available from EOP.

In the short duration of this program implementation, the modified courses in the proposed ESD specialization had total enrollment of 295 students: 34 high school students, 251 undergraduates, and 10 graduate students. The Buckeye PreCollege Institute course enrolled 11 high school students from across the country. Further, in the Autumn semester, there were 23 students from a Columbus high school enrolled in Introduction to Humanitarian Engineering. Our upper-level courses often include a few graduate students, but the balance of enrollments is comprised of undergraduates.

Students had positive feedback regarding the EOP Framework integration, with one student noting in their final reflection "I have also learned a significant amount about the fundamentals of human-centered design and engineering for one planet. The core tenets of these frameworks are ideas that I wish to carry with me into my future career, specifically the idea of sustainability being a core tenet in project design. Sustainability in engineering is an idea that has grown to be incredibly important to me throughout the semester, so in the future when I am looking for a company to work for I hope to find one that embraces the notion of sustainability."

Further, project leads participated in activities where the EOP framework was explicitly delivered and tied to the learning outcomes and activities of various courses and research projects; this included informal faculty and leadership meetings. Through our efforts, there were 72 faculty who received/accessed the EOP framework during the grant period: 50 engineering and 23 non-engineering. Among these recipients: Associate Dean for Undergraduate Education and Student Services (CoE), an Interim Vice Provost, and a former President of The American Society of Mechanical Engineers. These faculty represent a broad range of disciplines and units across the university enterprise: Office of International Affairs; Office of Diversity and Inclusion; Food, Agricultural and Biological Engineering; Civil, Environmental and Geodetic Engineering; Engineering Education; and Anthropology.

Vance and Sours presented at the College of Food, Agricultural and Environmental Sciences' Teaching and Learning Symposium. The audience was comprised primarily of non-engineering faculty and students. Sours presented at the 2023 International Virtual Exchange Conference in Sao Paulo, Brazil, where he had conversations with several non-engineering faculty. Vance presented about convergence research at the American Society of Agricultural and Biological Engineers' Annual International Meeting. This presentation included specific elements of the EOP framework, which resulted in the acceptance of a perspectives paper to the Journal of the ASABE.

Vance presented the EOP framework, as part of a proposal for the ESD specialization, to the faculty of the Department of Food, Agricultural and Biological Engineering. These presentations occurred informally at faculty meetings, then highlighted during the Faculty Retreat in early January. The ESD proposal, which prominently featured the EOP framework, had been distributed to the chair, then the Academic Affairs Committee, then to the faculty at large.

Recently, the Global Capstone program was recognized as a Program of Excellence in Engaged Scholarship by the Vice Provost for Outreach and Engagement in the Office of Academic Affairs.

**Next Steps and Synergistic Opportunities**

The future of our program is here. We continue to integrate cultural awareness (measured by the Intercultural Development Inventory) into our curriculum. As a crucial professional skill, intercultural competence is critical to address structural injustice & environmental racism. Through the use of Humanitarian Engineering concepts, Engineering for Sustainable Development (ESD) emphasizes the social dimensions of contemporary engineering, highlighting the demand for STEM students to develop intercultural competence and equip them with the capacity to address wicked problems and global sustainability challenges.

*Expansion of Content*

Water access and treatment comprises a substantial portion of our current offerings. Without discounting that growing need, there are also opportunities to develop sustainability content related to climate resilience, data analytics, and artificial intelligence. Further, we are developing relationships with the Wicked Science Interdisciplinary Graduate Specialization to offer additional pathways for students to participate in this space.

*Micro-credentialing*

There are growing career opportunities in the ESD space, and an increasing number of atypical or non-traditional career paths [16]. Also, the aforementioned AAC&U report [10] concluded that since 2014 employers put more emphasis on the ability to collaborate in diverse teams and solve problems from multiple perspectives. Given the value that employers place on intercultural knowledge and global competence in their workforce, training in the ESD space would be desirable to our industrial professional partners. Portions of the ESD specialization core and technical electives could be offered as a professional development package with a certificate upon completion.

*Collaborations outside of OSU main campus*

Given the demand for Sustainability theme courses, Intro to Humanitarian Engineering is now being offered on Newark campus. We have also developed strategic relationships with Central State University, an HBCU, in hopes of offering COIL/VE experiences and summer research opportunities. Recently, the Introduction to Humanitarian Engineering students had an opportunity to participate in virtual exchanges with An-Najah National University, a Palestinian non-governmental public university. Further, we have leveraged relationships with AguaClara Reach and Agua Para el Pueblo (Honduras) to bring high-impact learning experiences to our students. We continue to cultivate international and domestic relationships to extend opportunities to advance ESD.

With these synergistic activities, we aim to 1) broaden participation for STEM students of color, which tend to gravitate to vocations & professions with strong empathy and equity foci; and 2) expand faculty contributions, for those deterred by the perceived restraints of the current curriculum structure.

**Summary**

The Engineering for Sustainable Development Specialization is a forward-thinking initiative designed to revolutionize engineering education by leveraging the Engineering for One Planet Framework. By emphasizing socio-cultural learning, the curriculum equips students to tackle complex global sustainability challenges. The focus of this effort was curricular transformation, proposing an ESD specialization within the Department of Food, Agricultural, and Biological Engineering at The Ohio State University. This builds on the Humanitarian Engineering Minor, creating pathways for students to engage with sustainability-focused, socially responsible content. The initiative strives to balance student learning with community impacts, integrating Sustainability, Intercultural Competence, and Cultural Awareness as core engineering tenets. Efforts include developing General Education courses aligned with the OSU Sustainability Theme, engineering electives promoting social responsibility, and a certificate program for industry partners. Impact assessment measures increased cultural awareness, broadened STEM participation for students of color, and expanded faculty contributions. Future efforts aim to build on the success of this pilot effort to envision a holistic transformation of engineering education, fostering socially responsible engineers equipped to address pressing global challenges.

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