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Lessons from the Revolution: Reshaping Curriculum and Culture in an Environmental Engineering Program

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Lessons from the Revolution: Reshaping Curriculum and Culture in an Environmental Engineering Program

Abstract

Montana State University's Environmental Engineering (EENV) program recently completed a 5-year National Science Foundation (NSF) Revolutionizing Engineering Departments (RED) project. We proposed to develop an innovative curriculum featuring project-based courses that integrate technical and non-technical skills around the major thematic threads of Sustainability, Systems Thinking, and Professionalism. We also aimed to cultivate a collaborative teaching and learning culture that rewards the use of pedagogical best practices for continuous professional development throughout the undergraduate program. This paper presents a comprehensive overview of our work with respect to process, implementation, and lessons learned. We developed the knowledge and core competencies deemed necessary for our graduates as a list of technical and non-technical outcomes based on ABET program outcomes, the Fundamentals of Engineering exam, Body of Knowledge documents from both the American Society of Civil Engineers and American Academy of Environmental Engineers, and the Engineering for One Planet report sponsored by the Lemelson Foundation. We describe the new integrated project-based courses we developed for our first- and second-year EENV students addressing Sustainability, Systems Thinking, and Professionalism. We also discuss several higher-level courses in the undergraduate curriculum that have been substantially modified through our RED project, and which serve both Civil and Environmental Engineering students. Throughout our RED project we collected survey data on formation of engineering professional identity by students enrolled in the new first and second year project-based EENV courses compared to those enrolled in only the introduction to Civil Engineering course. This data provides insights related to the efficacy of our pedagogical shift and areas where we could continue to improve our program. Finally, we reflect on lessons learned during the project and the lasting impacts of our RED project on department culture.

Introduction

The first environmental engineers were primarily concerned with providing drainage and sewage disposal for growing ancient cities. Improvements to these early sanitation systems were made slowly over time, but the work of providing clean water and removing human waste remained the focus of environmental engineers for many centuries. With the onset of the industrial age, environmental problems suddenly became more pronounced and continue to increase in complexity, magnitude, and urgency to the present day [1]. Now, almost half of the National Academy of Engineering's grand challenges relate directly or indirectly to environmental engineering [2]. The National Academy of Sciences further defined the grand challenges for environmental engineering in the 21st century to include sustainable food, water, and energy; climate change mitigation and adaptation; elimination of pollution and waste; development of efficient, healthy and resilient cities; and improved decision making and actions [3]. According to a recent survey of almost 3,000 engineers in 80 countries, environmental issues will be their number one global challenge over the next 25 years [4]. Solutions to these challenges require environmental engineers be trained in such a way that they can integrate concepts not only from mathematics and the natural and physical sciences, but also from the humanities, arts, social sciences, business, and communications.

Engineering education has long been criticized for its reliance on a hierarchical, topic-focused curriculum model in which students encounter discipline-specific engineering practice late in their programs of study. Engineering education research and accreditation criteria have for some time emphasized that to adequately prepare engineers to meet 21st century challenges, programs need to move away from traditional approaches, with siloed topic-based technical content, toward an integrated approach that interweaves technical, social, and professional knowledge, skills, and real-world experiences throughout the curriculum [5-7]. An integrated approach allows students to draw connections between different disciplinary knowledge content, develop professional skills through practice, and relate their emerging engineering competencies to the problems and communities they care about [8-10]. Despite the known benefits, the challenges to implementing such major programmatic changes are myriad, including faculty's limited expertise outside their own disciplinary area of specialization, time constraints, and existing institutional structures and reward systems.

In response to these challenges, Montana State University (MSU) undertook a five-year NSF **Revolutionizing Engineering Departments (RED)** project to transform both the curriculum and culture of its Environmental Engineering (EENV) program. Our vision was to prepare graduates who can think systemically, act professionally, and design sustainably by embedding these competencies throughout the undergraduate experience rather than relegating them to isolated courses or a senior capstone. Central to this effort was cultivating a collaborative faculty culture that supported shared ownership of the curriculum, sustained coordination across courses, and collective responsibility for student learning.

This paper contributes to the engineering education literature by offering a longitudinal account of a department-level transformation effort. Rather than focusing on a single course or intervention, we synthesize findings from multiple years of curriculum redesign, course implementation, assessment, and faculty development. In doing so, we highlight both the technical work of curricular restructuring and the cultural work required to sustain meaningful change.

RED Project Overview

The RED project was guided by two overarching goals. The first was curricular: to replace a predominantly topic-focused curriculum with an integrated, project-based learning model that introduces environmental engineering practice, context, and identity formation early and reinforces them throughout the program. The second goal was cultural: to cultivate a collaborative departmental culture in which faculty collectively define program-level outcomes, share ownership of student learning, and engage in continuous pedagogical improvement.

Before the project, MSU offered a traditional topic-focused undergraduate curriculum. Fundamental concepts were taught in required math, science, and mechanics courses in the first two years. Core courses in social science, humanities and "external" disciplines were sprinkled throughout a student's program of study, without any meaningful connection made to the practice of engineering. Finally, students only experienced engineering problem-solving in upper level and capstone courses, delaying their engineering identity formation. Making connections between different knowledge areas was left up to individual students.

Likewise, faculty were responsible for designing and delivering content to achieve the specific outcomes they set for their individual courses. There was minimal expectation for faculty to be aware of where or how concepts were taught in other courses, and therefore no way of reinforcing and building upon student learning across the curriculum. In other words, faculty felt ownership over their individual courses but not for the pedagogical design and delivery of the program as a whole.

To overcome this siloed approach, the RED project brought together a core team consisting of all tenure-track Environmental Engineering faculty to deconstruct and redesign the EENV curriculum. The project was supported by collaborators from Civil Engineering and external disciplines including philosophy, political science, business, and writing studies. This multidisciplinary structure was essential for defining non-technical outcomes outside the conventional environmental engineering curriculum we wanted our students to achieve, and for modeling the collaborative practices we sought to instill in students. High-level curriculum redesign decisions were made collectively by this multidisciplinary project team. This shared governance structure proved critical for building faculty buy-in and establishing a sense of collective ownership over the transformed curriculum.

Central to our approach was the identification of three primary thematic threads—Sustainability, Systems Thinking, and Professionalism—that bridge technical content across courses and years (Figure 1) and connect traditional engineering knowledge with non-technical aspects of engineering practice. These threads reflect the competencies increasingly expected of practicing environmental engineers, provide an organizing framework for both curriculum design and assessment, and speak to the values we want our program to cultivate in our graduates.

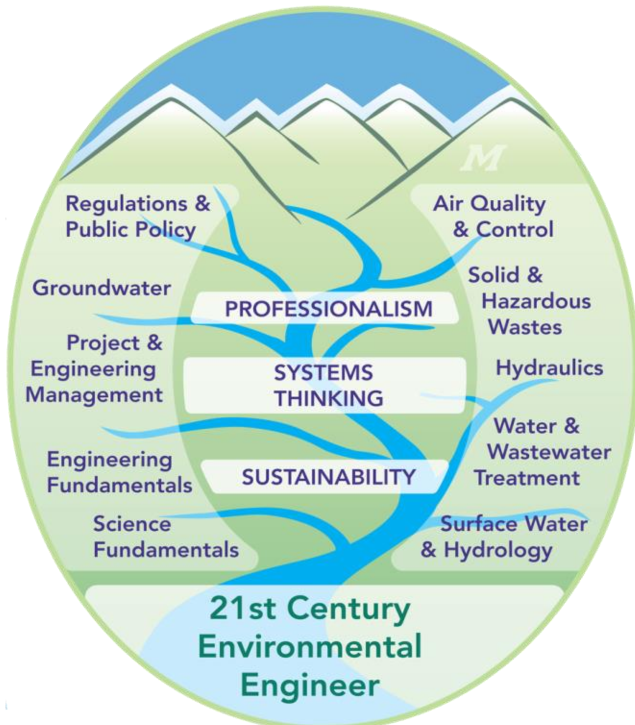

Figure 1. Our RED project integrates technical environmental engineering content with non-technical professional skills, systems thinking, and sustainability.

The remainder of this paper is organized as follows. The *Process* section describes our outcomes-based approach to curriculum deconstruction and redesign. The *Implementation* section details new and revised courses developed through the RED project and discusses resource and workload considerations. The *Engineering Professional Identity Formation* section presents early findings about curricular change impacts on student engineering professional identity formation as gleaned through surveys. The *Lessons Learned* section synthesizes key takeaways from the project and reflects on program sustainability and culture change.

Process: Outcomes-Based Curriculum Deconstruction and Redesign

We began the curriculum redesign process by articulating the knowledge, skills, values, and attitudes we believed essential for graduates of our Environmental Engineering program [11]. Importantly, this work was conducted without reference to existing courses. This intentional decoupling allowed faculty to think expansively about professional preparation rather than incrementally modifying the status quo.

Desired technical outcomes were informed by multiple external frameworks, including ABET student outcomes, FE exam specifications for Environmental Engineering, discipline-specific Body of Knowledge documents, and the Engineering for One Planet framework. Together, these sources helped ensure that technical outcomes reflected both accreditation requirements and emerging expectations related to sustainability, systems thinking, and professional practice. We relied on subject-matter experts from our full RED team to help us develop non-technical outcomes related to communication, ethics, social justice, public policy and regulations, and project management that are important to environmental engineering practice. The three primary thematic threads—Sustainability, Systems Thinking, and Professionalism—emerged organically from the process of developing our program outcomes and serve as connective tissue across the curriculum, helping relate the technical and non-technical outcomes.

We developed a hierarchical framework consisting of knowledge threads, competency strands, and competency domains to organize our desired program outcomes [12]. Within each thread, competency strands represent major topical or skill areas. As an example, the “Professionalism” thread encompasses four strands: communication, teamwork, social justice, and ethics. These strands are further subdivided into competency domains that define specific learning outcomes. This structure allowed us to visualize how outcomes could be scaffolded across courses and years, and it provided a common language for faculty discussions about curriculum coherence and integration.

Table 1 shows a sample selection of professionalism outcomes focused on communication skills. The table also shows the Bloom’s taxonomy level we assigned to each of the example outcomes to highlight how these outcomes can be scaffolded into the curriculum. We based our assignments of the appropriate level of Bloom’s taxonomy on the Body of Knowledge (BOK) documents for Environmental Engineering and Civil Engineering (Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation). In most cases in these BOK, students will not reach the highest levels of Bloom’s taxonomy during their undergraduate education. However, the progressive development of these skillsets throughout the undergraduate curriculum prepares students for achievement at the highest Bloom’s levels through mentored experiences in the workplace or graduate education.

Table 1. Selected examples of intended communication learning outcomes as mapped to knowledge thread, competency strand, and corresponding level of Bloom's Taxonomy.

Outcomes/Domains	Knowledge Thread	Competency Strand	Bloom's Level
Identify the common forms and conventions for texts common to environmental engineering writing (emails, progress reports, research reports, technical memo, technical report, specs, proposals, request for information, public announcement, presentations)	Professionalism	Communications	Knowledge
Explain the values and uses of common sources, evidence, and practices to develop meaningful content for the various writing contexts within environmental engineering	Professionalism	Communications	Comprehension
Constructs texts that successfully and correctly integrate figures and language.	Professionalism	Communications	Application
Evaluate peers' texts and communicate appropriate and constructive feedback on organization, mechanical, and stylistic choices in a variety of genres to peers	Professionalism	Communications	Evaluation

Once outcomes were defined, we systematically mapped them onto the existing curriculum using a collaborative "sticky note" mapping process. Each outcome was printed on an individual sticky note. Faculty then met in a classroom setting where the titles of all required courses were written at relevant positions on whiteboards, roughly corresponding to curricular sequence and year. As a group, faculty physically placed and repositioned outcome sticky notes beneath the courses where the outcomes were introduced, reinforced, or emphasized. This iterative, hands-on process supported discussion and consensus-building while allowing faculty to visualize how outcomes were scaffolded across courses and years, and fostered a shared, in-depth understanding of the intended outcomes within and across courses. Upon completion, the final mapping was preserved using photographs and transferred to posterboard for documentation and later reference. This process revealed three categories of courses: (1) courses that already contributed meaningfully to desired outcomes, (2) courses requiring substantial revision, and (3) outcomes that did not appear in our existing program necessitating new course development.

Figure 2. Course outcomes were mapped to the existing curriculum and new courses with individual outcomes printed on sticky notes.

The mapping exercise made visible redundancies, gaps, and missed opportunities for integration, and it underscored the limitations of relying on students to independently synthesize learning across siloed courses. These insights directly informed decisions about where to introduce integrated, project-based courses and how to revise upper-division offerings.

Implementation

As part of the RED project, we developed a sequence of integrated, project-based courses designed to anchor each year of the undergraduate program. New courses were designed for the first and second year of our program, EENV 102 and EENV 202 [13]. We elected to retain the existing Multi-disciplinary Design course, EGEN 310, in the third year. This course serves students across the College of Engineering and covers many important aspects of teamwork and project management. It was not feasible with respect to faculty workload to replace a project-based design course offered at the College level with a similar course offered at the Department level. Instead, we converted our two-semester capstone courses, EENV 489 and 499 (2 credits per semester, 4 total), to a one-semester, 3 credit capstone course, EENV 499. EENV 499 was redesigned to build explicitly on students' prior experiences with integrated design, teamwork, and professional communication. We significantly modified another third-year course on business fundamentals, EGEN 330, to incorporate the procurement and management content from the first-semester capstone course. These changes to the EENV capstone course(s) required equivalent changes to the Civil Engineering capstone courses, ECIV 489/499 to a one-semester, 3 credit capstone course, ECIV 499. Further discussion of our new courses follows here.

EENV 102: Introduction to Environmental Engineering Design and Sustainability. This first-year course introduces the field of environmental engineering by exploring the engineering values of systems thinking, sustainability, and professional communication; engineering tools like Excel and GIS; and a range of environmental engineering career paths in a project-based learning format. The project topics covered in the first three years of the course offering included: 1) assessment of climate impacts to water resources projects (streamflow changes and hydraulic structure design or impact of community growth and/or wildfires to our community drinking water supply) and 2) topics related to campus sustainability improvements in transportation management, urban heat, or new campus infrastructure (new campus hotel development). A focus of the course is technical communication, so the course was scaffolded to have assignments submitted at intermediate dates throughout the semester for multiple points of feedback from the instructors and revision by the students. Students developed their technical communication skills toward multiple diverse audiences by including project stakeholders in the project descriptions. This course is discussed in more detail in previous papers about this project [13],[14].

In the traditional Environmental Engineering curriculum model previously offered at MSU, first-year students did not receive more than a cursory introduction to Environmental Engineering topics and practice beyond a quick overview in the 1-credit *Introduction to Civil Engineering* (ECIV 101) course. The implementation of EENV 102 was designed to address this gap, providing incoming students with an in-depth introduction to environmental engineering career pathways, highlighting systems thinking and sustainability concepts integral to environmental engineering design work, developing students' familiarity with basic engineering tools (like GIS and Excel), and building teamwork and communication skills through project-based learning.

EENV 202: Sustainable Waste Management. The second-year project-based course builds on EENV 102 by further reinforcing systems thinking concepts, introducing ethics and social justice topics, and presenting technical content related to solid and hazardous waste management with a life-cycle assessment project. Ethics and social justice topics are relevant to waste management given the social, economic, and historical context surrounding the placement of landfills, incinerators, and hazardous waste disposal sites and the public participation process now required by federal regulations. Much like the LCA process, we included technical content in the course related to extraction and processing of materials like plastics and metals, as well as disposal strategies like landfills, recycling, waste-to-energy, and composting. We have used LCA software developed by EarthShift Global to perform the LCA analysis – EarthSmart in the first course offering, and MatterPD in subsequent offerings. The project topic has varied. We have previously tracked laboratory waste streams [14] and classroom furniture. Both projects were designed with the intent to provide useful information to MSU faculty and administrators about sustainability issues. The current year project will focus on food and food waste.

The EENV 202 course provides an opportunity for students to apply their knowledge and skillsets to an environmental issue that expressly demands they consider the potential ethical and social justice implications or disparate impacts of proposed engineering solutions. In this way, ethical considerations are integrated into how students are evaluated on their proposed engineering design solutions. Rather than ethics being taught in a stand-alone course, generally through case study review, students are required to be able to articulate and measure the social impacts of design decisions as part of the engineering design learning process. This pedagogical shift embeds desired systems thinking skills into how engineering design is taught.

EENV 499: Environmental Engineering Design (Capstone). In the traditional engineering education model, the senior capstone is the pinnacle of the curriculum, in which students are asked to pull together all the technical and multidisciplinary knowledge and skills they have acquired through three years of prior coursework, and apply it to a real-world engineering project. Senior capstone course instructors have a lot of heavy lifting to do to cover all desired outcomes. In the redesigned curriculum, students gain experience with team-based, project-based design work throughout their program of study, allowing the senior design course to be more narrowly focused. The capstone course was modified from a two-semester course sequence to a single semester 3-credit hour course. In the past, the first course in the sequence concentrated on project management skills that have now been integrated earlier in the redesigned curriculum. The redesigned capstone course focuses on the application of these skills through the development of an engineering proposal in response to an RFP, comparison of preliminary design alternatives, production of a workplan and project schedule, and production of design reports at various levels of completion. Students focus on project design and design documentation during the capstone, and work with their teams to produce and document proposed designs, to adhere to a project schedule, and to communicate possible solutions to an engineering problem concisely in preparation for their emergence into the workforce. The redesigned course was offered for the first time during the Spring 2025 semester.

Implementing an integrated, project-based curriculum required careful attention to faculty workload and resource allocation. Team-teaching, coordination meetings, and project development all represent significant time investments. To maintain sustainability, we developed shared course materials, established clear roles for lead instructors, and created guidelines to balance collective decision-making with instructional autonomy. Institutional support, including recognition of curriculum development work in workload and evaluation processes, was essential for sustaining faculty engagement.

Impacts: Student Engineering Professional Identity Formation

Throughout the RED project, we collected qualitative survey data examining students' development of engineering professional identity (EPI) [15]. Surveys were administered to students enrolled in the project-based EENV courses (EENV 102, 202, and 499) and, for comparative purposes, to students in the traditionally structured Civil Engineering program. The Civil Engineering introductory course, ECIV 101, and senior design, ECIV 499, were used as the control group (Table 2). The survey was distributed at the beginning and again at the completion of each course to measure change in student perceptions resulting from course participation. Surveys were administered between Fall 2022 and Spring 2025. Senior capstone students in both EENV 499 and ECIV 499 were only surveyed in Spring 2025. A total of 462 survey responses were received and analyzed out of a total enrollment of 604 students.

Table 2. Courses surveyed regarding development of engineering professional identity included all of the new project-based EENV courses and traditionally structured courses in the Civil Engineering (ECIV) program.

Course and Semester	Name	Enrollment	% response - PRE	% response - POST
ECIV 101 - F22	Control_1	156	34%	29%
ECIV 101 - F23	Control_2	162	21%	20%
EENV 102 - F23	1st yr_1	58	50%	52%
EENV 102 - F24	1st yr_2	65	57%	69%
EENV 202 - Sp24	2nd yr_1	31	84%	29%
EENV 202 - Sp25	2nd yr_2	43	72%	47%
EENV 499 - F24	4th yr_4cr	10	-	60%
EENV 499 - Sp25	4th yr_3cr	30	-	73%
ECIV 499 - F24	Control4th yr_4cr	20	-	75%
ECIV 499 - Sp25	Control4th yr_3cr	29	-	90%

In the survey, students were asked to respond to a series of open-ended questions designed to elicit their perceptions of the engineering profession and the roles engineers play in society in the context of three domains of EPI development (individual, social, and systemic) [10, 16]. Analysis of these open response data will be presented elsewhere. In addition to the qualitative survey data, we asked students to rank in order of importance or value to their chosen field of engineering eight core competencies—technical knowledge, systems thinking, public policy, management, communication, ethics, teamwork and social justice—that represent the integration of technical engineering content with the non-technical knowledge and skills identified by the team as necessary for 21st century engineers.

For students in the ECIV 101 control course, rankings of the core competencies show there was stronger consensus that social justice does *not* prepare them for engineering than there was that technical knowledge *does*. There was more variation in rankings of the importance of different competencies among students enrolled in the new RED project-based courses, both between courses and over time within the same course offering. The largest shifts were often in the lowest ranking competency. This may be attributed to students perceiving that topics *not* addressed in a given course are of lower value to the profession of engineering [15]. Overall, the RED curriculum is designed to provide more context and to challenge students' early preconceptions of engineering practice by providing a more holistic introduction. Survey results indicate that environmental engineering students enrolled in EENV 102 and EENV 202 exhibit greater variety and change in their pre- and post-course perceptions than their compatriots in ECIV 101. These findings indicate that the RED courses are challenging and building upon students' initial perceptions of engineering values and critical competencies.

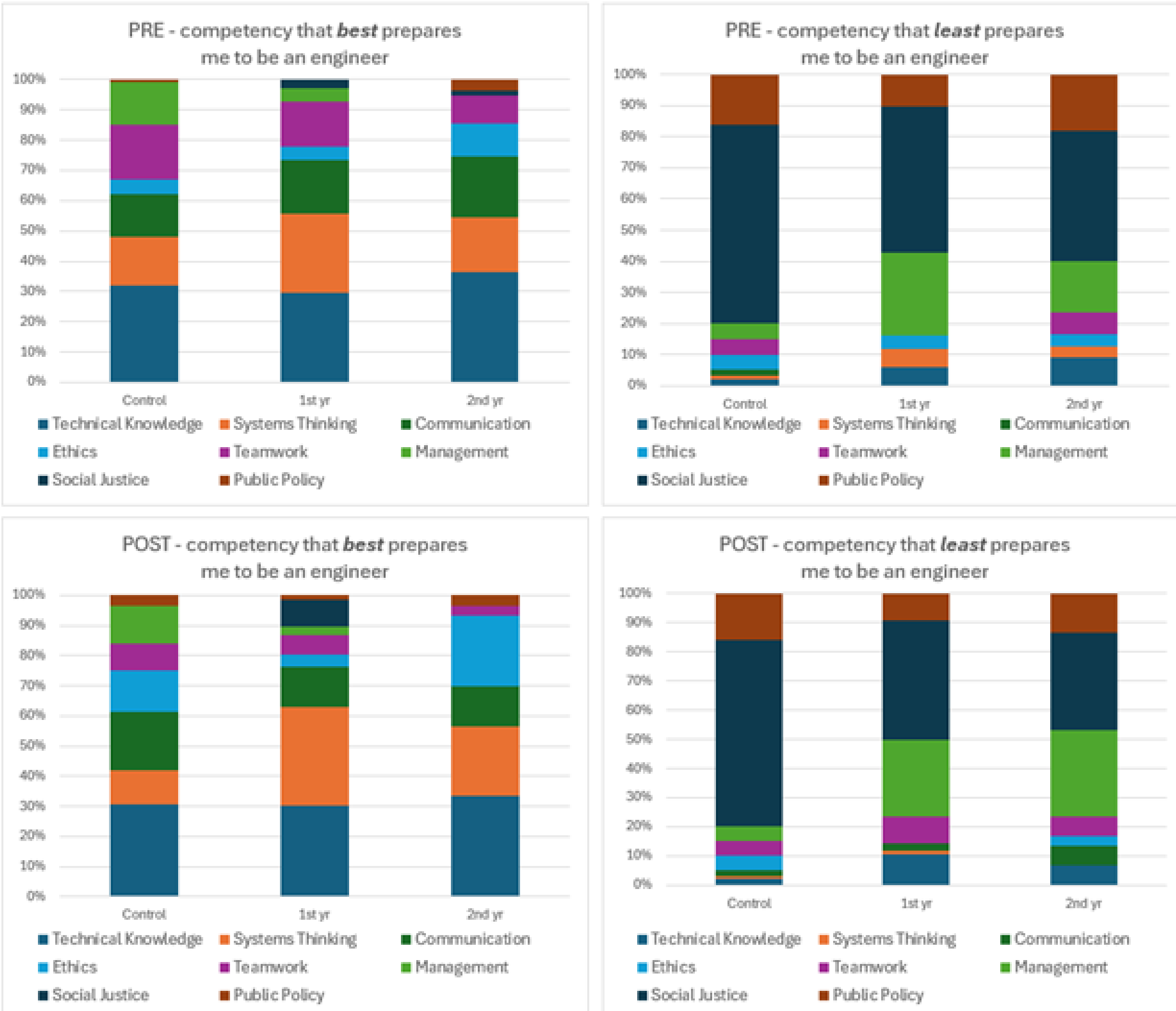

Figure 3. Students in the two new project-based courses, EENV 102 and EENV 202, and students in an introductory civil engineering course, ECIV 101 (control course) ranked eight core competencies at the beginning and end of the semester according to what best and least prepared them for an engineering career.

Students were also asked to rank the importance of the three threads: Sustainability, Professionalism, and Systems Thinking. There was substantial consistency across all groups in the 100- and 200-level classes with respect to the thread with the most value to engineering, Sustainability, and the least value, Professionalism [15]. Significantly, however, the number of students ranking Sustainability highest declined in post-course surveys for students enrolled in ECIV 101. Environmental Engineering students, on the other hand, ranked Sustainability as most valuable at similar levels before and after completing EENV 102 and EENV 202 [15]. In the 400-level capstone courses, EENV students continued to rank Sustainability highest and Professionalism lowest. ECIV students, however, ranked Professionalism and Systems Thinking highest (tied) in both semesters, with Systems Thinking lowest in the 4-credit version, and Sustainability lowest in the 3-credit version. This indicates that while many civil engineering and environmental engineering students may enter programs with sustainability goals in mind, these values can diminish over time if they are not emphasized in course content as important elements in engineering practice.

Lessons Learned

Lesson 1: Outcomes-Based Design Enables Integration

Beginning with desired outcomes rather than existing course outcomes was critical to us for achieving meaningful integration. Even with the stated intent of breaking the siloed approach, we found it difficult to change our mode of thinking. In developing outcomes, we often reverted to thinking about what is covered in "that class" instead of thinking broadly about what outcomes we wanted to achieve in the program overall. We also found ourselves resistant to significantly changing the content in our existing technical courses. This was partly due to the staffing and logistical constraints of a small program. Moreover, each faculty member has developed technical expertise in their area of interest, and we each love to share that knowledge with our students.

Developing outcomes at the appropriate level to guide course revision and integrated course development was difficult. Often, we either developed outcomes that were too vague and general or far too specific. Initially, in fact, we created a list of 700 program outcomes! Developing the final set of programmatic outcomes was a messy, non-linear process that required multiple iterations and revisions and much discussion to achieve clarity. This approach helped faculty move beyond incremental change and provided a shared reference point for decision-making. In addition, the process gave faculty a detailed understanding of how individual courses functioned within the broader curriculum, making gaps, redundancies, and missed opportunities for integration visible. Importantly, this shared, collaborative work served as the initiation of a broader shift in environmental engineering faculty culture, which is discussed in the following lesson.

Lesson 2: Culture Change is as Important as Curriculum Change

Sustained curriculum reform required intentional attention to faculty culture. Developing shared meanings around key concepts such as sustainability and professionalism enabled more consistent teaching practices and reinforced collective ownership of the program [17]. In addition, the collaborative mapping and discussion process fostered stronger working relationships among tenure-track faculty, supporting shared responsibility for teaching and encouraging joint development of courses, assignments, and instructional materials. Faculty also have more frequent and productive cross-course conversations about student learning, allowing instructors to better coordinate expectations and build on students' prior experiences across classes.

Lesson 3: Integration Requires Ongoing Support

Integrated, project-based curricula demand coordination, flexibility, and institutional support of faculty efforts. Team teaching and cross-course coordination increase instructional workload and require sustained collaboration. Without explicit recognition of this additional work in workload models, evaluation processes including tenure and promotion, and resource allocation, even well-designed reforms risk erosion over time. A related challenge is that these changes were not implemented uniformly across programs in the department, making it difficult to advocate for additional resources in contexts where comparable instructional demands are not present.

The project grant was able to support faculty time spent in weekly meetings, curriculum design, outreach and dissemination work. The initial design of EENV 102 and EENV 202 involved a team of two faculty members, and the first offerings of the new courses were co-taught with each faculty member receiving full credit in workload calculations. However, even before grant funding ended, faculty realized this was not a sustainable model moving forward. There were too few faculty in a small department with too many courses to cover to allocate two tenure-track faculty to a single course each semester. Instead, the department moved to a model utilizing a faculty lead and a graduate student teaching assistant acting as an equal co-instructor. This model recognizes the additional workload required for faculty to manage large entry-level project-based courses and allocates teaching support to address it, but not at the expense of other professional elective and graduate level course offerings. The graduate student instructor gains mentored experience teaching and managing a project-based integrated course.

The collaborative process in designing EENV 102, EENV 202, and EENV 499 integrated project-based courses also means that there is greater flexibility in assigning different faculty to teach them. The entire faculty team feels ownership and responsibility for these courses. Faculty leads share adaptations they make to course projects and tools with the entire team, allowing the courses to develop and change over time as newly assigned course instructors integrate lessons learned from previous offerings. This approach avoids stagnation of the curriculum into a new status quo and fosters continuous pedagogical improvement and faculty collaboration. New faculty collaborations are also evidenced by increased co-teaching in other courses offered in the department.

Conclusion

The RED project has had lasting impacts on both curriculum structure and departmental culture. Faculty report greater awareness of how individual courses contribute to program-level goals, and students encounter environmental engineering practice earlier and more consistently throughout their education.

While challenges remain, particularly related to workload and assessment, the structures and shared commitments developed through the RED project position the program for continued evolution and improvement. The first cohort of students to complete the full RED project redesigned curriculum will graduate in Spring 2026.

Our experience demonstrates that transforming an environmental engineering program requires simultaneous attention to curriculum, culture, and community. By integrating sustainability, systems thinking, and professionalism throughout the undergraduate experience, we have taken meaningful steps toward preparing engineers equipped to address complex, real-world challenges. We offer these lessons as a resource for other programs pursuing systemic change in engineering education.

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