Developing a Framework for Experiential Learning

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Work in Progress: Developing a Framework for Experiential Learning

Abstract

This is a work-in-progress paper submitted to the ASEE Cooperative & Experiential Education Division.

As part of a recent strategic vision process in the College of Engineering at the University of Michigan (U-M), faculty, staff, and students are engaged in a process for considering the role of experiential learning beyond the existing academic, technical, and disciplinary graduation requirements. The goal of the initiative (the Experiential Learning Framework) is to provide students with a framework to intentionally explore learning opportunities, engage meaningfully in experiences, reflect on what they have learned, and communicate the value of the core competencies they have developed. As most Michigan Engineering undergraduate students participate in experiential activities, the framework aims to provide students with richer and more meaningful experiences and more intentional engagement and reflection. This paper provides an overview of activities to date, key challenges, and possible paths forward.

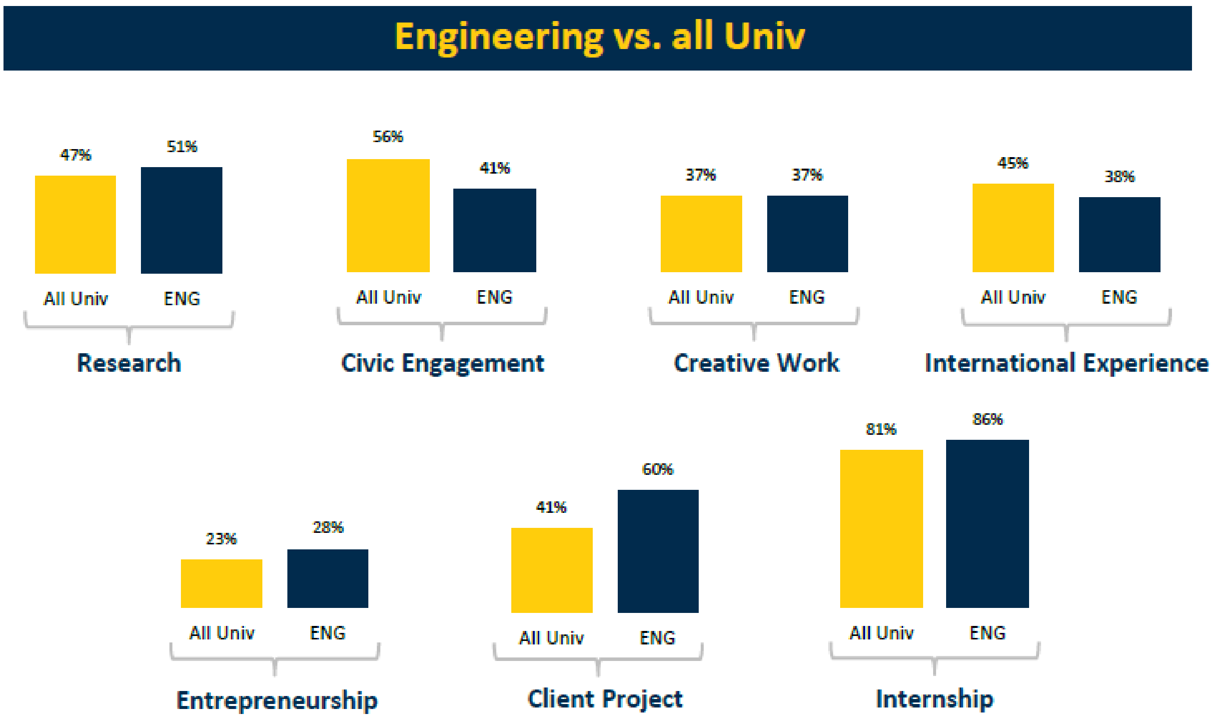
Introduction and Overview

Numerous institutions are focusing on expanding experiential learning opportunities (e.g., client-based projects, international service trips, team competitions) for engineering students. Kolb [1] defines experiential learning as an iterative process involving conceptualization, active experimentation, concrete experience, and reflective observation. Experiential learning has also been identified as an important pedagogical feature of current engineering education leaders in the recent MIT report The Global State of the Art in Engineering Education [2]. Many believe experiential learning provides more real-world learning environments and opportunities to build competencies that may not necessarily be provided in the classroom such as leadership, problem solving, and teamwork.

As part of a recent strategic vision process in the College of Engineering at the University of Michigan (U-M), faculty, staff, and students are engaged in a process for considering the role of experiential learning beyond the existing academic, technical, and disciplinary graduation requirements. With support from College administration, this idea continues to be developed through interviews, surveys, round tables, and a discussion series that have involved students, faculty, and staff. The goal of the initiative (the Experiential Learning Framework) is to provide students with a framework to intentionally explore learning opportunities, engage meaningfully in experiences, reflect on what they have learned, and communicate the value of the core competencies they have developed.

An important first step in our work involved developing a better understanding of current experiential learning activity within the College. Over 10,000 students, including 7,350 undergraduates, are enrolled in the College of Engineering at the University of University. Through a rich opportunity mix including hundreds of student organizations, curricular opportunities, co-curricular opportunities, research and entrepreneurial experiences, team competitions, and others, 98% of 2018 engineering graduating seniors (Figure 1) reported involvement with at least one type of the following experiences—research, civic engagement, creative work, international experience, entrepreneurship, client project, or internship [3]. College of Engineering (n=1604) student engaged learning participation rates are slightly higher than the University (n=7,138) overall with engineering students only reporting lower participation rates for civic engagement and international experience. However, what is not known is the degree of reflective learning associated with these activities.

Figure 1: Engaged Learning Participation Rates [3]



Number of types of experiences	% Univ overall	% Engineering graduating seniors
None	4%	2%
At least one	96%	98%
Multiple	85%	86%

A survey of College of Engineering faculty activity related to experiential learning also identified significant engagement. Based on the responses from 60 faculty, over 81% reported that they are currently involved with experiential learning activities. These activities split nearly evenly between degree requirements (e.g., courses, major design experiences, capstone design) and non-degree requirement activities (e.g., supporting undergraduate research, advising student teams and organizations) [4].

Following the faculty survey, we then completed individual interviews with 18 College faculty from a wide range of departments to expand our thinking about existing experiential learning opportunities, resources required to further support experiential learning, and concerns about what was already in place. Faculty were selected based on whether they were already known champions of experiential learning or if they had expressed concerns about expanding efforts around experiential learning. While no one thought that experiential learning itself was a bad idea, concerns were raised about resources, student and faculty workload, and implementation plans. A set of recurring themes emerged which included: determining which activities/experiences count, identifying the appropriate structure (curricular/co-curricular, credit/non-credit, required/not required), and creating a program at scale while ensuring accessibility and a meaningful learning experience for all students.

In addition to student and faculty input, a recent scan of current experiential learning activities at the undergraduate level identified 79 courses, 44 programs (curricular and co-curricular), and 103 student organizations which offer some aspect of experiential learning. These opportunities were identified through reviewing department and College websites and course lists on department websites.

Given the already high rates of engagement among students and faculty, our group quickly determined that one of our main efforts should focus on developing learning resources rather than expanding opportunities for students.[1] Through several informal conversations, we heard from both students and employers about the need for students to reflect and be able to communicate the value of their experiences in relation to their technical skills and career aspirations. This point is reinforced by the comprehensive analysis completed by Burning Glass Technologies [5] of the difficult time employers have in finding employees with the professional skills needed for the workplace and the importance of professional competencies highlighted in the Technology in Industry Report [6].

In parallel with these efforts, a group of students—consisting of engineering juniors and seniors who served as student leaders—independently formed a group to investigate experiential learning at the College of Engineering. In September 2019, the group wrote a report describing (1) guiding principles for creating and implementing the Experiential Learning Framework, (2) definitions of competencies that are developed through experiential learning, (3) examples of undergraduate experiences that use experiential learning to develop competencies, (4) a proposal for structuring the Experiential Learning Framework, and (5) concerns such as diversity, equity, and inclusion and student buy-in. We frequently reference this report and continue to elicit feedback from the group as we develop the framework.

Following an initial review of all the input we were gathering, we realized that we needed to do more than simply provide a checklist of approved activities. To more broadly support experiential learning, an important first step in this work would be to develop a set of key experiential learning competencies. Described in the next section, this set of competencies would also be important for addressing the recurring themes and guiding decision making around program implementation.

[1] It should be noted, however, that related efforts are also underway to determine which students are not yet participating. This has generated new programs focused on first-generation and middle-income students who tend to report lower rates of engagement than their peers [3].

Experiential Learning Key Competencies

Using conversations from multiple viewpoints on our campus, resources from national organizations [7]–[11], and a review of engineering education literature, our group has identified and defined 12 competencies to be developed through participation in experiential learning initiatives on our campus. To begin the identification process, we used campus conversations such as the 2019 student report (described above), the Educational Experience Commission (EEC) report on experiential learning from the strategic vision initiative [12], and preliminary definitions developed by experiential learning program directors within the College. In addition, we also used the newly modified Accreditation Board for Engineering and Technology (ABET) student outcome criteria [13] to draft a list of competencies of interest to our group. In doing so, we found that many of the conversations, both locally and nationally included similar competency outcomes for engineering students. Table 1 indicates where we saw relationships between three of our selected initial sources: 2019 University Student Report, 2018 EEC Report, and ABET.[2]

Table 1: Key Competencies by Source

	Student Report	EEC Report	ABET
Communication	X	X	X
Creativity	X	X	
Empathy	X	X	
Entrepreneurial Mindset	X	X	
Ethics	X	X	X
Global/Cultural Awareness		X	X
Grit/Persistence/Resilience	X	X	
Leadership	X	X	X
Lifelong Learning	X	X	X
Risk (Ability to Accept and Manage Risk)	X	X	
Systems Thinking (Authentic Problem Solving)	X	X	X
Teamwork	X	X	X

From there, we utilized a literature review to understand how the 12 competencies were defined and discussed in the literature. Starting with the national reports referenced above, we looked through the literature used to inform those initial reports, pulling literature that referenced co-curricular, extra-curricular, experiential learning, or any of the competencies in the titles. We

[2] There are other ABET student outcome criteria which do not overlap with the experiential learning competencies we have identified. These are Design Knowledge/Skills, Conduct Experiments and Analyze Data, and STEM Knowledge/Skills. These criteria are more technical in nature and address different skill sets than the competencies we are developing.

then expanded the search to three databases (Scopus, ProQuest, Google Scholar) using the same search terms (i.e. co-curricular, extra-curricular, experiential learning, or any of the competencies). After the database search, we performed a search in the databases of two common engineering education journals (Journal of Engineering Education – JEE; European Journal of Engineering Education – EJEE) and the American Society for Engineering Education's (ASEE) PEER database for relevant prior conference publications.

Using these resources, we compiled definitions for each competency and synthesized these definitions into a brief one sentence definition to present to College faculty and staff for feedback. From there, we received feedback on the clarity and completeness of the definitions at two round-table sessions. The definitions were then modified, and the most updated version of the competency definitions can be found in Table 2 below. The goal is not to have students develop all 12 competencies, but that students will intentionally engage in experiences which allow them to develop several of the competencies over time. Students will be encouraged to consider new areas for exploration and development while also striving for higher level synthesis in other areas.

Table 2: Key Competencies Definitions

Competency	**Definition**
Communication	Ability to critically read, listen, reflect, and convey information effectively in a variety of media with diverse audiences with different needs and perspectives across a variety of settings and contexts.
Creativity	Ability to generate ideas, processes, products that are both novel (unique, original, atypical, cutting-edge) and appropriate (relevant, practical, useful, applicable, fitting, effective).
Empathy	Ability to understand, appreciate, value the perspective of someone else by reasoning from their premises, assumptions, or ideas.
Entrepreneurial Mindset	Ability and intent to engage proactive, innovative strategies in various contexts to solve ambiguous problems.
Ethics	Fully engage stakeholders to recognize that actions and choices have consequences, and that one must act with integrity and trustworthiness.
Global/Cultural Awareness	Ability to acknowledge, practice, and articulate one's own cultural identity to better appreciate, adapt to, and interact with individuals from differing backgrounds, values, and cultures.
Grit/Persistence/ Resilience	Ability to persevere and maintain passion/commitment for achievement of long-term goals, despite setbacks, failure, and/or adversity.
Leadership	Cultivating an environment that collectively develops a shared purpose and inspiring others to work toward it.

Lifelong Learning	Ongoing desire and fundamental ability to recognize personal skills/knowledge deficits; seek out and acquire needed skills and knowledge; and continue to grow new interests, talents, and passions.
Risk (Ability to Accept and Manage Risk)	Ability to critically assess available information, take action despite uncertainty, manage outcomes, and learn from failure as well as from success.
Systems Thinking (Authentic Problem Solving)	Ability to recognize and appreciate the complex structures and their interconnectedness which are embedded in a system while maintaining a view of the highest-level objective to be achieved.
Teamwork	Working to define and achieve a shared goal by leveraging individuals with different perspectives, roles, responsibilities, and aptitudes to overcome and use conflict to their advantage to create a more robust solution.

Experiential Learning—What Counts?

In addition to competencies, we also worked to define what experiences might count as experiential learning. Defining what counts is important to (1) ensure that students engage in each step of the iterative experiential learning process, (2) align students' experiences with key competencies, and (3) facilitate student, faculty, and staff navigation through the Experiential Learning Framework.

We used several methods to identify current students' experiences that could count as experiential: the census of engineering graduating seniors, the survey of College of Engineering faculty, interviews with College of Engineering faculty, and the student report on experiential learning. They revealed a broad range of experiences: curricular and co-curricular, technical and non-technical, and short term and long term. Additionally, the student group created engagement spectra to show the diverse set of experiences in their student organizations.[3]

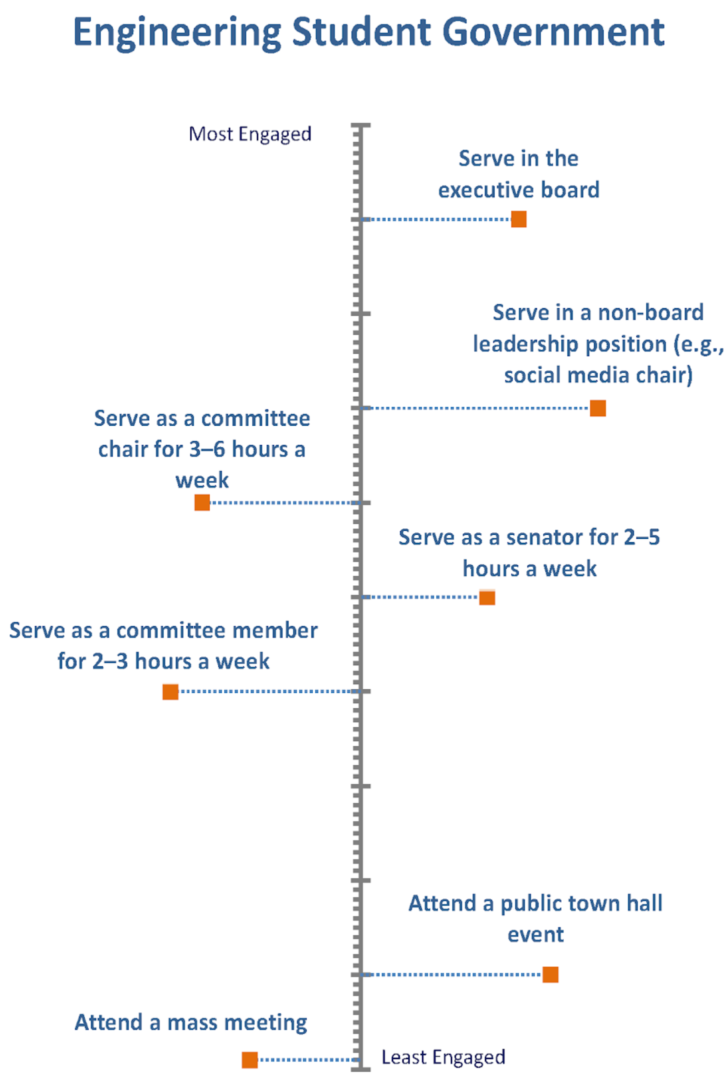
Figure 2 offers an example of an engagement spectrum for Engineering Student Government. At the top of the spectrum are experiences that represent the most engaged students in the student organization and, at the bottom, are experiences that represent the least engaged students in the student organization.

We used the engagement spectra during two round-table sessions to elicit feedback from faculty and staff about what experiences they considered significant enough to qualify as experiential learning. We asked participants to examine a spectrum and (1) describe three competencies that they thought were best suited to the experience; (2) indicate, with a line, the level of engagement that should be encouraged in order to provide sufficient depth for competency development; and (3) discuss an appropriate length of time that students should be involved.

[3] Special thanks to the student group for developing the engagement spectra, and, in particular, Fee Christoph (Computer Science and Interarts Performance undergraduate student) for designing the template.

Participants agreed that non-technical experiences developed competencies. However, some participants were concerned that these competencies would not be transferred to future technical experiences and emphasized the importance of using reflection to actively facilitate the transfer of competencies. Participants generally indicated that a medium level of engagement should be encouraged to provide sufficient depth, drawing their lines halfway up the engagement spectra, and identified that students should be involved for enough time to experience at least one iteration of the experience (e.g., one competition cycle for project team, one experiment for undergraduate research, one academic year in a leadership position for social organizations)—on average two semesters. A notable theme that arose from the discussion was the importance of mentorship, either when students are being mentored or when they are providing mentorship to others. Participants also emphasized the importance of students taking ownership of their learning and responsibility for their actions in experiential learning experiences. For example, on student project teams, students must identify and learn new skills to contribute and are responsible for the successes or failures of their projects.

Figure 2: An Engagement Spectrum for Engineering Student Government



Creating the Foundation for Exploration—Engineering 110

Establishing a strong mechanism to support students in the intentional exploration of learning experiences is integral to the success of the experiential learning framework. In order to accomplish this, we will leverage Engineering 110, an existing elective course that currently serves around 300 students per year (approximately 20% of first-year engineering students). Engineering 110 provides students the opportunity to explore the breadth of educational and career opportunities available to engineers.

Engineering 110 is engaged in a multiyear redesign process through a University-wide effort to transform high-impact, large-enrollment introductory courses at U-M. Prior to this effort, the course was offered in a lecture/discussion format, with all students completing the same set of required assignments. The lecture consisted of guest speakers providing information about engineering departments, specific opportunities and the field more broadly. Despite being presented with information about the available learning experiences, enrolled students indicated a lack of confidence in making educational decisions [14]. In addition to the lecture, upper-level students mentors led weekly discussions (15-25 students per discussion) on topics such as strengths, identity and values, which are necessary to support the development of future plans [15] and thereby an integral component of experiential learning.

In early 2020, we piloted a new model for the course that will further advance course goals and lay the groundwork for the experiential learning framework. Additionally, the new model will remove existing barriers to scaling this course to a more significant proportion of our students. Through the pilot course we seek to address a wide array of student learning needs, including differing readiness for educational planning and decision-making.

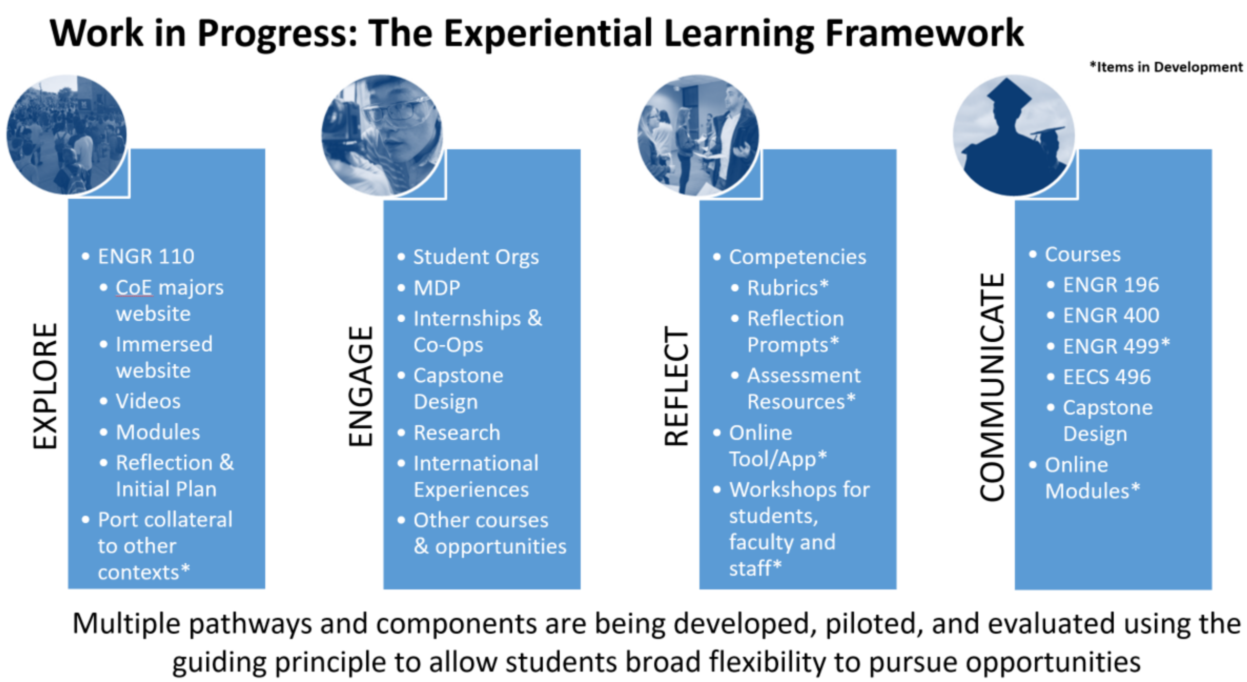
The pilot course model replaces the lecture component with a blended learning approach, combining the existing small group discussions with online modules. Students tailor their learning experience by choosing which modules to explore and which types of mentors to engage (peers, advisors, faculty or alumni). Students are required to complete fifteen modules from a selection of forty, with guidance to ensure breadth of exploration and connection to mentors. Modules establish a foundation of knowledge for the course and guide students through an exploration of the majors and co-curricular learning experiences. For example, one model introduces an engineering design process as a mechanism for making decisions in the course and beyond. Another set of modules encourages students to select specific co-curricular learning opportunities to explore and then engage with advisors/mentors as they develop their plans to get involved.

After completing the modules and engaging in discussions, the final component of the class is the creation of a plan in which students will identify a set of specific and measurable goals for the coming semesters or years. This expands beyond short-term planning that was incorporated in previous offerings of the course. This plan will provide students with a record of their exploration in Engineering 110 and establish a schematic to move them from exploring opportunities to engaging in meaningful experiences. Through the redesign process, we will continue to assess the pilot class and adjust the model accordingly in preparation for launch in fall 2020.

Possible Paths Forward

Our work is currently focused on developing multiple experiential learning paths that can be piloted and evaluated (Figure 3). These paths include existing design experience courses, exploration modules like those in Engineering 110, and internship and co-op reflection seminars (ENGR 196 and 400). We are also considering the development of new courses (ENGR 499) and online modules to support synthesis and storytelling so that students are well-positioned to describe their technical and professional skill competencies. A central element and hopefully unifying component of this approach is a new online tool we are developing with U-M Center for Academic Innovation. Based on social behavioral prompts grounded in self and peer learning objectives, we plan to build the tool around the competencies and assessment rubrics we are developing. The tool could suggest competencies that align with a student's experience (e.g., Global/Cultural Awareness and Communication as part of a study abroad experience), guide the student through a self-assessment of their skill level, offer reflection prompts throughout the experience, and curate the experience in a way that supports effective communication of learning outcomes. The tool will be available to students throughout their undergraduate experience as a resource for courses and co-curricular activities. A key learning in our work to date is that we realize there will be no "one plan" that works for all our students. Some may follow a curricular path, others may follow a co-curricular path, and others will pursue a blended plan based on their learning styles, schedules, and sequence (cohort or transfer students).

Figure 3: Experiential Learning Framework



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