Work in Progress: Development of Career Preparation and Portfolio Modules in a First-Year Engineering Course

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Introduction and Background

There has been a growing emphasis on the development of professional skills for engineering students [1]. ABET, the National Association of College and Employers (NACE), and the National Academy of Engineering (NAE) all indicate the importance of teamwork, communication, problem-solving and critical thinking, project management skills, and ethical impact [2, 3].

Many students develop teamwork and communication skills in the first-year engineering course through hands-on, team-based semester long design projects [4]. However, several aspects of professional development, including career development and project documentation for career development, could still be further supported in the first-year. While more engineering schools are offering professional development or professional practice courses, these are typically offered in the junior or senior year [5]. By the senior year, students are expected to have had professional experience. There is a disconnect between the timing of these courses and industry expectations. More recently, faculty at Vanderbilt University piloted an open elective career development course which was promoted to rising sophomores, juniors, and seniors [6]. And, some first-year programs have begun to implement more career preparation through modules and badging programs [7, 8].

Similarly, portfolios as project documentation and career development tools have been adapted across engineering education [9-12]. Some first-year courses have implemented project portfolios as a reflection and assessment tool [13]. However, they do not make or teach an explicit connection between portfolio documentation and project communication for future job applications or other career opportunities.

Setting

This first-year engineering course is taught in a large, private university in the US Northeast region. The course is one semester long, with lecture, lab, recitation, and a semester-long design project. Roughly 350 students take the course in the Fall semester, and 300 enroll in Spring semester. Lectures are led by the first-year faculty director and invited faculty, administrators, or industry guests and introduce students to relevant topics in engineering education. In recitation, engineering and writing faculty lead active sessions on technical presentation and writing skills, the engineering design process and design thinking, ethics and stakeholder impact, undergraduate and graduate opportunities, and more. Students will also present on their weekly lab activities or project milestone updates and receive feedback. Faculty provide guidance on the enhanced career development assignments, which now include a resume, cover letter, LinkedIn profile, and a digital portfolio. The cover letter and portfolio assignments are new for the 2022-2023 academic year and the design and implementation are described below.

Module Creation and Implementation

Implementation of these new career development and professional skill modules is part of a large-scale effort driven by faculty and administrators across the school to support curricular and co-curricular experiential learning opportunities [14]. The first-year faculty director had been involved in the school's curriculum overhaul committee before the pandemic and advocated for an additional credit hour to be added to the first-year course during the 2021-2022 academic year as the new support for professional skill development was championed by the dean's office. All first-year faculty researched and outlined potential topics during the course redesign, which included implementing peer evaluations and additional teamwork feedback sessions [15] and the new professional skills modules. The proposal was submitted and approved by the curriculum standards committee and academic departments at the end of that academic year, increasing the first-year course from three to four credit hours.

Previously, students had been required to create a resume. The amount of feedback they received varied by faculty member and course section. The enhanced career preparation module was designed to embed further career development opportunities throughout the entire semester. Students are required to create a cover letter for a specific opportunity of their choosing and encouraged to tailor their resume to that position and use their LinkedIn and portfolio as supporting material. They are required to find a specific internship or co-op, but they can also discuss with their faculty member if they would like to use it for a summer research, teaching assistant position on campus, or other type of experiential work opportunity.

For the portfolio, students are provided a step-by-step guide to create a simplified WordPress (WP) site through the university's web publishing service. WP was chosen as a common skillset, with free hosting provided by the university. The sites can also be migrated to their own hosting service once they graduate. For the final deliverable, students must create About Me and Projects pages on the site, with guidance for each. If a student has created a portfolio in high school and wants to instead update that site on another hosting platform, they can again discuss with the faculty member. Some of the guidelines for the portfolio assignment were adapted from the makerspace portfolio workshops and other supporting content. Several members of the full-time staff in the makerspace come from an industrial design or creative technology background. They host office hours and workshops on portfolio development through the Design Lab open to the whole university. Students in the first-year course are encouraged to connect with them.

In addition to the collaboration with the makerspace staff and Design Lab, these assignments and course expansion were supported by the new Assistant Dean of Student Life & Services, who supervises the engineering career services office. Over the past academic year, she was invited to lead a guest lecture early in the semester, typically in the third week as shown in Table 1. The engineering and writing faculty collaborated on a series of slides and activities to prepare students as they work on the new assignments. The activity is typically presented two weeks before the assignment is due. For example, cover letters are discussed in week 8 and due in week 10 of the semester. The collaborations across services and offices at the school, as well as the recitation activities, were designed to help first-year students form connections for support as they begin their academic journey and start to think about career opportunities.

Table 1: Updated Semester Schedule for Lecture and Recitation

Week	Lecture	Recitation (Engineering Faculty)	Recitation (Writing Faculty)
1	Intro + Project Opportunities + Makerspace + TA Panel	Intro to Engineering	Writing Lab Reports
2	Teamwork Lecture and Skit + Project Based Learning Across the School	Technical Reports	Citing Sources & Paraphrasing
3	Career Services in Engineering and Across the University	Technical Presentations	LinkedIn
4	Project Management + Writing	Engineering Design	Technical Writing Standards
5	Health	Metacognition & Design Thinking	Resumes
6	Sustainability	Ethics & Stakeholder Impact	Data is Your Argument
7	Urban	Reflection & Design Canvas	Team Writing
8	Telecommunications/IT	UG Opportunities	The Art of the Cover Letter
9	Artificial Intelligence	Graduate School	Portfolios
10	Invited Engineering Industry Guest	Career Opportunities	Resumes Revisited
11	Project work time	Engineering & Social Justice	Writing as a Professional
12	Project work time	Emerging Topics	Writing in Engineering
13	Project work time	Entrepreneurial Mindset	--

Results and Discussion

The career preparation has been implemented successfully and builds on strengths from all instructors, both the engineering and writing faculty. Students are provided with more personalized feedback and have time to discuss and ask questions about their cover letter in recitation. They have been able to successfully create a LinkedIn, resume, and cover letter tailored to a specific internship or other work or research opportunity. The collaborations across different support offices have been designed to help students more easily understand how to navigate the university system and resources.

The portfolio assignment and assessment are still a work in progress. Because the bulk of the assignment is due as a final deliverable, there is little chance for substantive feedback on the portfolio, and students need additional guidance. In the Fall semester, several students “gave up” on that assignment and just submitted the portfolio link with minimal information on the site. In the Spring semester, most students successfully created an initial portfolio page which satisfied the requirements, but faculty still did not have time to provide feedback at the end of the semester. To scaffold the assignment and provide students with additional feedback, in-class recitation time to work on the portfolio will be provided.

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