Enhancing Career Development for Engineering Students Through e-Portfolio Curriculum Implementation

Alyssa Ball and Mr. Brandon Crisel
University of Arkansas Department of Industrial Engineering

Abstract

The Biggadike e-Portfolio Research Team was challenged with improving career development for students within the University of Arkansas' College of Engineering. The research team consisted of members of the university's Department of Industrial Engineering, which is where implementation was focused and coursework completion began to take place. We did background research, studied various portfolio creation software applications, and interacted with stakeholders and industry representatives to determine the optimal creation and implementation methodology, allowing the portfolios to gain traction and aid students in their career development, as well as the most effective means of integrating the curriculum into standing courses without disrupting the current course schedule. We implemented the coursework for two consecutive semesters, improving documentation iteratively throughout the semester and between implementations, and is preparing for a third iteration of student completion of the portfolio creation coursework. As we have examined students' experiences with the creation of the portfolios in the past two semesters, they are considering furthering the outreach of the curriculum to more courses. The team expands their scope in an effort to extend the outreach of e-Portfolios to other departments within the College of Engineering to achieve the same goals for a wider variety of engineering students, and considers other applications such as recruiting, grading, and other documentation use cases. The team also discusses the most effective means of implementing curriculum such as this in order to protect the integrity of academic programs and property, while ensuring the ease and accessibility of an electronic portfolio for all students.

Keywords

Professional Development, Engineering Education, High Impact Practice, Electronic Portfolios, Curriculum Implementation

Background

The Biggadike e-Portfolio Research Team was presented with the goal of improving career development for students within the University of Arkansas (U of A) College of Engineering (CoE). The team determined through online research, interactions with industry representatives, and discussions with stakeholders that electronic portfolios would be a new and effective means of improving career development for students within the CoE while simultaneously giving them a resource to catalogue their academic achievements. Electronic portfolios (e-Portfolios) are "a purposeful collection of sample student work, demonstrations, and artifacts that showcase student's learning progression, achievement, and evidence of what students can do," as defined by the UC Berkeley Center for Teaching and Learning [1]. Various platforms were tested for

efficacy against the conditions that the platform be free, easy to use and learn, and available to students after they leave the university. Once the creation medium had been decided, the team conducted further investigation to determine the most effective method of relaying this material to students. Ultimately, it was determined that the most significant characteristics of the curriculum are that it is easy for course instructors to implement while also being sufficiently robust for students to follow outside of the classroom given the appropriate resources for troubleshooting. The team determined that sophomore level Industrial Engineering (IE) and one freshman honors course were early enough in department/college curriculum to introduce students to the content, enabling them to graduate with the most robust collection of documented academic experiences while still ensuring that students were exposed to the appropriate amount of code writing before attempting to code their portfolio. Not only does this introduce the content at a great time in their learning journey, but courses in the CoE at the university begin implementing projects as early as freshman year. This means that students are showcasing skills as early as their first semester as undergraduates, and they are able to use this to aid in both their learning and portfolio creation. Further, this implementation plan inspired us to create the most thorough materials possible and helped us narrow down methodology to ensure maximum accessibility for students.

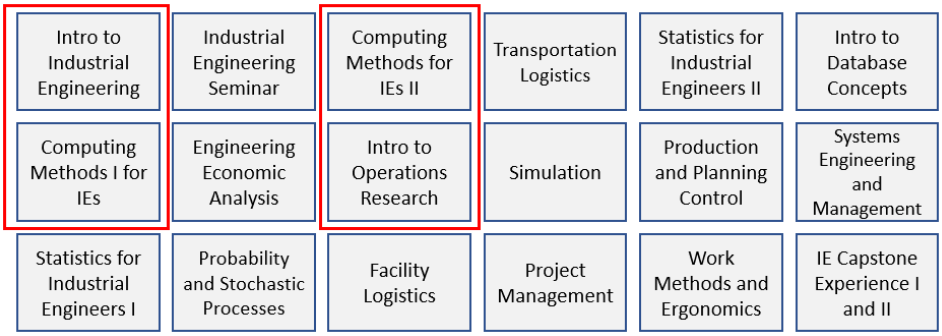

Figure 1: Courses in U of A IE department where e-Portfolio curriculum has already been introduced or plans of future introduction are in progress.

Iterative Implementation

The team first introduced the content to the Fall 2023 on-sequence cohort of sophomores graduating in 2026 in the Introduction to Industrial Engineering (Intro to IE) course and a freshman honors research section of the Introduction to General Engineering course offered by the First Year Engineering Program. Given that this was the first implementation of the coursework and approximately 100 students were enrolled across both courses, a member of the research team spent two available class days lecturing on e-Portfolio content. The second implementation was in the same course in the Spring 2024 semester, which was an off sequence offering of the course, meaning that there were significantly less students enrolled. A member of the team spent a single day lecturing on e-Portfolio materials during class time for this iteration of the content implementation. For future iterations, we will not be lecturing on course content during class time, and students will solely rely on curriculum documentation, as it has been improved for their ease of use.

Between each of these iterations, documentation was modified, and additional content was created based on the first experience with implementation. Areas where students struggled were

examined more closely by the team to narrow in on portions of the content that could be made more robust and easier to follow. Given that the students were not yet familiarized with programming in a markdown language when they began working through the coursework, syntax errors were a priority for furthering curriculum documentation. Separate documents were created to detail common syntax errors with the integrated development environment and the markdown language itself. Students were also cautioned regarding the "pickiness" with which the program behaves as code is compiled and run. For example, any spare white space, colons, or capitalization errors can cause the entire program not to run – something they had not yet come across in their undergraduate careers. Many troubleshooting errors were common of all coding languages, but embedding PDF documents was another area where documentation was needed, as students needed to know how to change the dimensions and general readability of embedded documents on their portfolio website pages.

After viewing the projects added to students' portfolios, we came together to characterize the type of project that is best suited for students to include in their portfolios. The goal was for students to have a collection of work that was both personalized to their capabilities and experiences, but also displayed the skills taught during their time at the university. Ultimately, the research team and project stakeholders concluded that the most beneficial type of content to include were projects (typically final projects) with topics chosen by the students. For example, for the Computing Methods II for Industrial Engineers course taught during the second semester of students' sophomore year, students are given a list of requirements that their project must meet, but the topic is up to their determination. Students must deliver certain functionality in their program, but they can select the outcome/output and choose their own dataset so long as it meets project requirements. Many other courses follow this same practice, including the Intro to IE Data Visualization project, which was the first project included on students' e-Portfolios during the first iteration of implementation, serving as a baseline for further e-Portfolio development considerations. It is key that students can publicly publish the links to their e-Portfolio websites, so academic integrity was a key consideration when discussing curriculum inclusion in the portfolios. This approach to project selection meets these conditions as outlined by the CoE and the research team, and these conditions are reflected in the project selection process previously outlined. Given that these projects are typically specific to a given course within the college and that the college is able to easily access all portfolios, it would be completely feasible to take inventory of any and all academic integrity violations for a given project.

Future

The future of the Biggadike e-Portfolio Research Team continues to work towards its goal of enabling students to competitively search for jobs and internships while also shifting focus and expanding the scope of the project. The team's advisor outlines four key points regarding this motion moving forward.

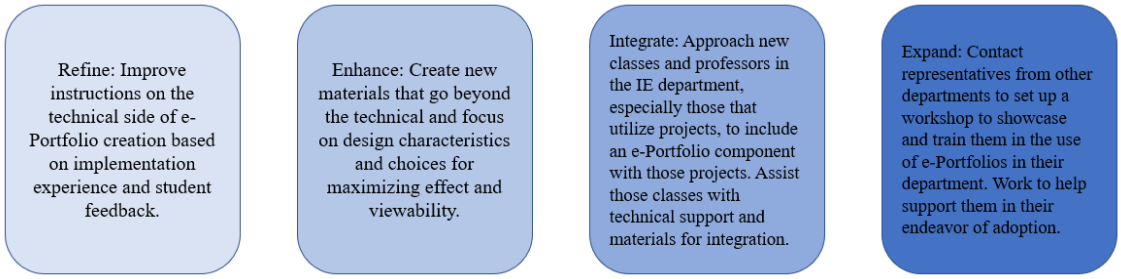

Figure 3: Four key points for project scope expansion.

The refinement of the materials has been a consistent objective for team members throughout the iterative implementation process. However, the goals described as Enhance, Integrate, and Expand place an emphasis on the team's goals for moving the coursework into other classes within the IE department as well as other classes within the CoE as a whole. At a high level, these objectives can be categorized as the desire to expand the material to benefit the large engineering populace. The groundwork for scope expansion has been laid as the majority of the technical components of the portfolio creation software have been worked out, enabling the team to focus their efforts on behaving functionally rather than technically in the project's future.

The team has begun the planning process for researching e-Portfolio efficacy for each of the engineering disciplines in the U of A CoE. Further, the team has begun discussing key stakeholders in other IE courses and other departments where e-Portfolio curriculum could prove to be a viable means of documenting student work for career development. To expand on this point, the team also considers the portfolios' potential benefit to the college as there are many other use cases for e-Portfolios in academic settings. These include recruitment and grading; recruiters can benefit from the sample students works as a means of exemplifying opportunities within a degree program while instructors can benefit from a single platform of well-organized coursework which may add simplicity to the grading process. Additionally, we consider use cases such as program reviews, lab reports, service learning, and more for e-Portfolios as their concise nature enables viewers to easily navigate to their page of interest within the portfolio.

Conclusion

The Biggadike e-Portfolio Research Team has made substantial progress in improving the methodology used to enable students to program electronic portfolios as a testament to their academic and professional capabilities and career readiness as they prepare to enter their respective engineering fields. Using this technical groundwork, the team focuses on bringing their collaborative efforts and ideas for project scope expansion to other courses and departments within the U of A CoE. The team is investigating the efficacy of e-Portfolios for a larger subset of engineering disciplines and intends to expand these tools not only further into the college, but further into a larger engineering populace. The team outlines these plans along with the many benefits e-Portfolios may offer engineering students and their programs.

References

[1] "e-Portfolio | Center for Teaching & Learning." https://teaching.berkeley.edu/resources/assessment-and-evaluation/design-assessment/eportfolio (accessed Aug. 06, 2023).

Alyssa Ball

Alyssa is a current senior undergraduate student in the Department of Industrial Engineering at the University of Arkansas. She serves in multiple roles in the department including her role as a Course Assistant for the Introduction to Industrial Engineering course and her role as a Research Assistant for the System Design and Analytics Laboratory. She is a member of the university's chapters of the Institute of Industrial and Systems Engineers (IISE) and the Society of Women Engineers, and has presented at events hosted by the American Society for Engineering Education (ASEE) and IISE.

Mr. Brandon Crisel

Brandon Crisel is an Advanced Instructor and Undergraduate Advisor in the Department of Industrial Engineering. He teaches courses including Statistics and Computing Methods. His engineering research has focused on systems reliability, but his continued research focuses on improving educational methods and practices in the STEM fields. He holds an ACUE Certificate for Effective College Teaching and is responsible for the Biggadike e-Portfolio Project. He has received multiple awards for teaching and service, including the inaugural Dean's Non-Tenure Track Teaching Award, the FEP Departmental Award for Teaching, and the Department Award for Service to IE students. He is a member of ASEE, IISE, and Alpha Tau Omega, and is an active FIRST volunteer.