

Developing and Implementing ePortfolio Coursework to Leverage Engineering Students' Skillsets for Improved Career Development

Alyssa Ball, Jacob Holmes, and Mr. Brandon Crisel

University of Arkansas Department of Industrial Engineering

Abstract

The Biggadike ePortfolio research team was presented with the goal of improving career development strategies for students within the University of Arkansas College of Engineering through high impact practices that will aid students' abilities to competitively search for internship and job opportunities. After determining that the team would focus on ePortfolio materials, the research began with determining stakeholders and key needs of the project and then finding a platform that would support these needs. Stakeholders were identified as certain faculty members within the College of Engineering and all engineering students, and the key needs are that the platform is easy to use and learn, free, and available after departure from the university. After testing multiple platforms for efficacy, Quarto was determined to be the most viable option that met all criteria. Additionally, research was conducted to determine the most effective method of coursework development and course implementation. This curriculum needed to be easily implemented into courses in a complementary manner. After researching a variety of learning models, the team determined that independent learning modules will be most effective for both students and faculty, as instructors will not be required to greatly alter their course schedules and students will be able to pace themselves through the material. Informative text documents and video content were then developed that guide students through the chosen platform in an introductory phase, followed by a basic editing phase and by supplementary personalization methods. The curriculum will be implemented into a First Year Engineering Program course and two sophomore Industrial Engineering courses for the Fall 2023 semester, after which potential methods of implementation into additional courses in the University of Arkansas Department of Industrial Engineering will be determined. Providing students with the knowledge and ability to create and maintain ePortfolios is valuable to career development, and the facilitation of updating these sites through a multitude of courses would benefit both the students and departments involved.

Keywords

Curriculum Development, High Impact Practice, Career Development, Portfolios (Background Materials), Engineering Education

Background

Electronic portfolios (ePortfolios) 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]. These dossiers can serve as tools to evaluate student learning and job candidacy. A team of university authors and researchers in 2017 wrote about their analysis of the efficacy of ePortfolios used by employers from studies conducted by various organizations. They convey survey results in which approximately 80% of the employers surveyed “considered ePortfolios useful when they demonstrated that applicants had the knowledge and skills necessary for success within their companies” [2]. Several of the other studies provided the conclusion that “ePortfolios served a key role in illustrating applicant credentials” [2]. Empowering students with the ability to develop impressive Presentation (or Showcase) Portfolios throughout their academic and professional careers rather than only the typical resume not only benefits students, but also their universities. These students can feel more confident in their acquired skills and their abilities to be outstanding contenders in a competitive workforce. Engineering, specifically, is often described as an ambitious field, where applicants and current professionals must be innovative and adaptive to ever-changing technological advancements. Equipping engineering students with the ability to portray themselves adeptly is a notably valuable tool that aids their experiences searching for internships and post-graduation job opportunities.

Methods

To address ePortfolio implementation, the key stakeholders and needs for the University of Arkansas’ College of Engineering needed to be determined. After discussion among the Biggadike ePortfolio research team and faculty within the Industrial Engineering Department in the College of Engineering, stakeholders in the university were determined to be faculty whose courses would be implementing the future ePortfolio curriculum and engineering students in those courses. The scope of course selection started small and with introductory courses. Thus, ePortfolio training would happen early within the curriculum to be implemented later in more advanced courses. Additionally, these courses were chosen due to professor interest, buy-in, and the type of courses that they already taught. Courses with an abundance of introductory topics that greatly differ from courses that a generous portion of students complete regardless of their field of study, such as calculus or physics, were chosen. The courses chosen are suited to the Industrial Engineering curriculum and generally result in multiple documents for students to share, exemplifying their learned skills. Following the course determination, meetings with faculty members and department leaders were held to determine different needs for an ePortfolio curriculum. These needs would suit an engineering professional who would be able to use and adjust this ePortfolio for the entirety of their professional career. Thus, an optimal ePortfolio platform would be easy to learn, free to use, available to use after undergraduate and graduate study, easily customizable, abundant with resources and how-to guides, and allow for engineering project displays, such as programming projects and demonstrations.

After the selection of ePortfolio platform criteria, a search of current website/blog/ePortfolio building platforms was conducted. The University of Arkansas currently has a contract with the WordPress platform, so it was considered. However, it did not satisfy the criteria of free use after undergraduate and graduate study and did not allow for certain technical specifications for

coding demonstrations with engineering students. Additionally, Jekyll, a website and blog building platform, was considered. It did not satisfy the “easy to learn” criteria, as it required the learning of Ruby, a programming language that is not already covered in the engineering curricula at the University of Arkansas. Furthermore, it did not include easy-to-use customization guides and resources for installing, running, and changing ePortfolios. Another platform that was considered was Quarto, a platform from Posit which created RStudio. Quarto did satisfy all requirements determined by stakeholders. It is also built from RMarkdown, a scientific communication markup language that is already used by faculty in the College of Engineering and students within varying departments.

A 2022 study done by KX Systems, a data analysis software developer and vendor, shows that, while almost 60% of high school and college students ages 16-23 in the United States “see coding skills as vital as foreign language skills for future career prospects,” less than half of this student population consists of fluent code-writers [3]. Bearing in mind that students generally show a legitimate interest in computer coding, with the caveat that a considerable portion of students do not begin college with any substantial knowledge of the topic, the coursework for ePortfolio creation was developed in a cautious manner. By using Quarto Markdowns through RStudio, the creation of the portfolio and the ways in which you edit it demonstrate an essential, technical knowledge of markup languages, specifically RMarkdown. Posit created Quarto as a means of enabling data scientists and others sharing important programming and coding information in industry to optimize their experiences – in other words, Quarto is “a reporting infrastructure that is automated, comprehensive, and easy to maintain, reducing the time spent creating and publishing reports” relating to data science [4]. Taking into consideration tested teaching methods and the barrier to usage of any sort of demonstrative platform for engineering students who are already involved in rigorous coursework, independent learning modules around this software were chosen to be formulated for a multitude of reasons. Studies regarding learning efficiency with individual, independent learning models have been consistent in that they “indicate the advantage of respecting individual differences in the learning management process” [5]. Additionally, independent learning modules would not require any drastic changes to the schedules in courses where this material was intended to be implemented, allowing the original curriculum to remain mostly unaffected. Furthermore, courses were chosen so that the creation of an ePortfolio would complement their curricula rather than present it as a detached assignment. By inquiring with professors and students familiar with ePortfolios about their experiences with the setup and revision of them, all with varying levels of experience using RStudio, problematic areas were able to be identified to ensure a seamless learning experience for students. Diverse text documents were developed and accompanied by video content which works from multiple angles to accommodate students’ various learning styles and personality types and ensure that this material is communicated as effectively as possible.

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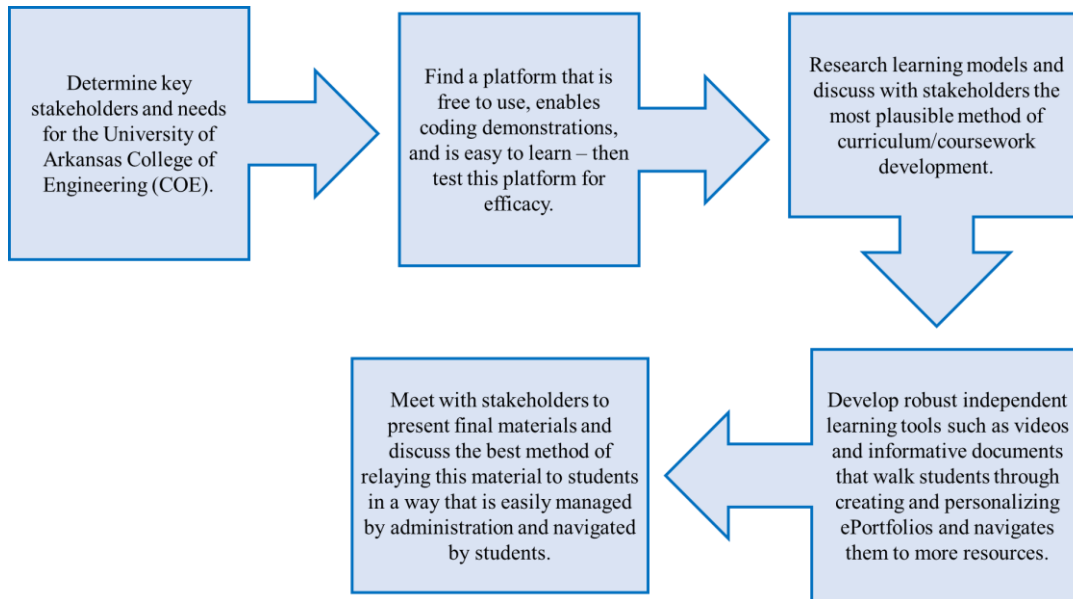


Figure 1. Flowchart summarizing methodology used for research, development, and implementation.

Implementation

After further discussion with stakeholders, methods to relay the newly formulated material to students have been considered. Through platforms that both students and faculty are familiar with, short videos and informative text documents with hyperlinks that allow students to navigate directly to the Quarto webpage will be implemented into a First Year Engineering Program (FEP) freshman course and two sophomore Industrial Engineering courses for the Fall 2023 semester. A research team member will be the Course Assistant for one of these courses which offers students an immediate resource to ask questions regarding instructional clarification and/or technical issues from someone who was behind the scenes for the creation of the curriculum. Looking into the future, the Fall 2023 semester will be used as a learning experience to achieve department-wide support and implementation of this material. Professors have decided which projects from their respective courses to instruct students to include in their portfolios based on what they believe is in highest demand in industry; this concept could be incorporated into a multitude of Industrial Engineering courses at the University of Arkansas and other College of Engineering departments, as the department faculty could advise the addition of their course materials into students' base portfolios. While enabling students to finish their undergraduate careers with a comprehensive portfolio of their skills is the overall goal, the ability to facilitate this implementation and curricula additions would ensure maximum benefits for both the students and the departments.

Summary

EPortfolios are useful in academic benchmarking and in career settings, demonstrating technical abilities and professional readiness. By empowering students to be fluent in crafting remarkable ePortfolios, curricula developed at the University of Arkansas will allow students to be competitive in the job market and allow for improved project presentation skills. The research group moved to develop and implement such curricula within the College of Engineering and its

Department of Industrial Engineering. This goal was addressed by identifying criteria for ePortfolio platforms and curricula, finding an ePortfolio platform that would meet these criteria, and developing a curriculum for the platform's use in the classroom. Future testing and implementation will take place in the Fall 2023 semester and results will determine additional implementation within the College of Engineering.

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Alyssa Ball

Alyssa Ball is an undergraduate student in the Department of Industrial Engineering at the University of Arkansas where she also serves as a Higher Education Institution (HEI) Program Coordinator, Introduction to Industrial Engineering (IE) Course Assistant, and IE Main Office Assistant. She previously served as a Social Media Content Creator for another department in the University of Arkansas College of Engineering.

Jacob Holmes

Jacob Holmes is an undergraduate student in the departments of Industrial Engineering, French, and German at the University of Arkansas, where he also served as a Teaching Assistant for Introduction to Computing Methods for Industrial Engineers I and as Data and Operations Coordinator for the Jane B. Gearhart Full Circle Food Pantry (JBGFCFP). He serves as a Higher Education Institution (HEI) Program Coordinator and Intern for the JBGFCFP.

Mr. Brandon Crisel

Brandon Crisel is an Instructor and Undergraduate Academic Advisor for the Department of Industrial Engineering at the University of Arkansas. He has a master's degree in industrial engineering from the University of Arkansas. He also has a master's degree in mathematics with emphasis in statistics and a bachelor's degree in mathematics from Arkansas State University. His STEM research has been in device and systems reliability and iterative functions. His primary research is in educational best practices, educational efficacy, and student support.