Student ePortfolios for Undergraduate Professional Development: A Comparison of Two Programs

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Electronic student portfolios (i.e., ePortfolios) promote professional development by causing students to reflect on what they have learned, integrating their often seemingly disconnected coursework, and constructing their own understanding of their chosen profession. Portfolio assignments can be useful for encouraging student self reflection and documenting achievement of student learning outcomes, especially those outcomes that are more difficult to assess such as communication, teamwork, ethics, life-long learning, knowledge of contemporary issues, and an appreciation for the impact of engineering within global and social contexts. "Portfolios...offer the most comprehensive information for measuring many outcomes and are conducive to evaluating professional skills" (Shuman et al., 2005).

The constructivist pedagogical approach implicit in these ePortfolio applications enables students to generate their own meaning while also allowing faculty assessment of student performance in individual courses and over a longer undergraduate career. A high quality ePortfolio combines the attributes of social networking media, blogs, and more traditional paper-based portfolios. They include artifacts that serve as evidence of achievement, and incorporate reflective short essays that provide context and connection between student experiences and their future professional and personal aspirations. They have been successfully used by students to showcase their accomplishments to potential employers. They have also been beneficial for engineering programs to communicate the achievement of student outcomes with ABET program evaluators and institutional assessment personnel.

This paper compares and contrasts the implementation of ePortfolios by two undergraduate biosystems / biological engineering programs at two different universities: Auburn University and the Ohio State University. One program embeds ePortfolio requirements over three years and four courses; the other program highlights the portfolio as the primary deliverable in one junior-level course.

Descriptions of the two ePortfolio approaches

Auburn University: The ePortfolio was introduced to the Biosystems Engineering (BSEN) program because of the difficulties expressed by seniors (to instructors of capstone design course and in the EBI Benchmarking data) about their ability to articulate the biosystems engineering profession, including the skills they have acquired as engineering students, to prospective employers.

Auburn students begin working on their ePortfolio in their sophomore heat transfer course, BSEN 2240. This ePortfolio highlights their academic accomplishments, encourages reflection, and can be used for job interviews. During the junior year, the fluid mechanics course, BSEN 3310, requires students to continue to build this online document. Two courses in their senior

year, a professional practice course BSEN 4300 and a capstone design course BSEN 4310, are used to further polish and refine their ePortfolios. Students are provided with examples of excellent ePortfolios from previous cohorts of students and from students in other programs at Auburn University. Choice of software platform is not mandated by the faculty; most students have chosen to use one of the freeware sites: Weebly.com and Wix.com

The Auburn students are required to include on their ePortfolio site the following materials:

a) reflections about the courses they have taken before that semester especially BSEN courses,
b) connections between these courses and the course which they are currently enrolled,
c) how the courses they have taken so far have moved them closer to their career plans/goals.

Students are also expected to include several paragraphs about themselves, and other experiences that may be related to their career goals and future plans. In addition, each senior design capstone project team is required to create a separate ePortfolio that articulates their capstone projects including reflection and narrative about the individual contribution of each member of the team.

Examples of ePortfolio sites developed by Auburn BSEN students are listed below:

- http://hallienelson18.wix.com/hallie-nelson
- http://kingbenpaul.wix.com/eportfolio
- http://ceg0032.wix.com/craiggranger
- http://elizabeth-m-bankston.weebly.com/
- http://matthewrevel.weebly.com/

The Ohio State University: The use of portfolios, along with the introduction of topics on professional skills and business practices, has been a feature in a required junior-level professional development course, FABENG 3140, in the Food, Agricultural, and Biological Engineering (FABE) program at the Ohio State University (OSU) since 2005, helping to prepare students for the engineering profession and encouraging them to reflect upon their undergraduate career. In 2015, the course instructors transitioned the previously hardcopy portfolio assignments into an ePortfolio. The first two years, students were required to use U.OSU.EDU, which is a WordPress website platform, branded for Ohio State. In 2017, The Ohio State instructors used the Auburn approach of not mandating any specific website software. As a result, OSU students used a variety of different ones including Weebly.com, Wix.com, WordPress (U.OSU.EDU), and Portfolium.

The FABENG 3140 professional development course is taught annually and is structured to explore several instructor-determined topics during the first half of the semester, followed by those topics selected by class consensus for the second half of the course. The topics that are included in every offering of the course (i.e., the instructor-determined topics) are the following:

- Professional business communications: Resumes, cover letters, memos, letters, proposals, reports, emails, professional portfolios
- Professional licensing and ABET
- Planning for graduate school

- Job interviews, follow-up letters and calls, and evaluating job offers
- Engineering ethics
- Occupational health and safety for engineers

The second half of the course highlights professional skills and business practice topics relevant to the engineering profession and to that particular group of students enrolled in the course. The selection of those topics is made during the first and second class meetings.

Draft portfolio assignments are graded using a rubric that provides guidance to students:

	What would an excellent example look like? ***(SCORE = +)***	**What would an acceptable example look like?** ***(SCORE = ✓)***	**What would an unacceptable example look like?** ***(SCORE = –)***
Audience awareness *[Course deliverables are intended to meet professional standards and to be viewed by potential employers. Course instructor provides feedback and evaluation but is not the ultimate audience.]*	Student persuasively articulates a clear purpose and recognizes the expectations that a potential employer might have for the materials within a professional context.	Student articulates a clear purpose and shows some recognition of the audience.	Purpose is unclear, and the student shows little recognition of audience or context.
Engagement with topic	Student not only follows the basic requirements for the assignment, but demonstrates a serious, thoughtful engagement with the topic, going above and beyond basic requirements.	Student follows the basic requirements for the assignment.	Student attempts but does not complete the basic requirements for the assignment.
Mastery supported by appropriate evidence	The selection of materials or completed assignment shows exemplary achievement of the corresponding ABET outcome.	The selection of materials or completed assignment shows acceptable proficiency in the ABET outcome.	Student fails to support claims with appropriate evidence or the evidence selected is unclear or not relevant.
Organization and logic	Student arranges material in a clear, persuasive way that an audience can easily follow and that strengthens the overall claims of mastery.	Student arranges material clearly so that an audience can follow reasonably well, but there are occasional gaps in thinking.	Material is poorly organized, and audiences may have a hard time following the student's ideas and logic.
Effective use of professional conventions	Student has carefully and thoughtfully proofread and followed appropriate stylistic and formatting conventions. Very few or no mistakes in spelling, grammar, word choice, and punctuation.	Work generally proofread, but some conventions have not been followed. More than a few mistakes in spelling, grammar, word choice, or punctuation, but these don't obscure the student's ideas.	Work has been poorly proofread, and stylistic conventions are not followed. Many distracting mistakes in spelling, grammar, word choice, and punctuation that obscure the student's ideas.

Assessment

Auburn students commented that the ePortfolio "organized thought" and "really sets you apart in the job market." BSEN seniors have informally commented that their ePortfolio has helped them prepare for job interviews because they are more comfortable with thinking through and expressing their understanding of connections between the courses that they have taken and the engineering competencies that they have developed. In addition, several seniors mentioned that employers have shown interest in their ePortfolio. This is in agreement with the comments by the department's advisory council members when the ePortfolio concept was first presented to them during the 2013 meeting and in subsequent meetings of that council.

At Ohio State, student performance on ABET outcomes as evidenced by grades on their portfolio assignments over four years are summarized in Figure 1. The average annual score did not fall below 80% on any outcome, reflecting the fact that these were materials specifically selected by the student to show their mastery of the appropriate learning outcome, and that many of these materials had already received instructor feedback in the courses for which they were initially submitted.

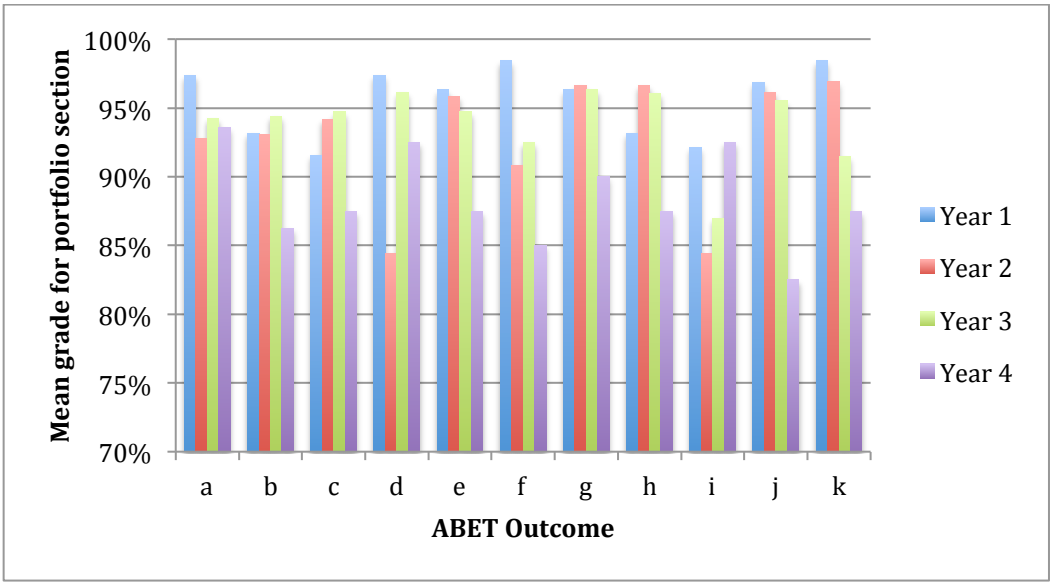

Figure 1. Assessment of student performance on portfolio assignments by ABET a-k outcome (from Christy, 2013)

ABET program evaluators have been very complementary about the portfolios, and how they provide the accreditation evaluator with a good overview of student outcomes attainment on an outcome-by-outcome basis. Employers have spoken with faculty about how impressed they have been by the creativity and professionalism exhibited by many of the portfolios. The instructors have observed that portfolios help shift the students' emphasis toward quality work, encouraging use of their evaluative and creative skills, and allowing them to take more control of their own learning.

Comparison and Discussion

The two programs' uses of ePortfolios were compared and contrasted with respect to timing, website software platforms, and faculty and student buy-in.

Timing: The Auburn BSEN program embeds ePortfolio requirements in their undergraduate curriculum over three years and four courses; Ohio State's FABENG program currently includes the ePortfolio in just one junior-level course. It is the opinion of the authors that ePortfolios can meet the goals of causing student self reflection, integration of coursework, and documentation of learning outcome achievement in either a one-time effort in a single course or a more distributed effort spread over several years and several courses, however the distributed model is more likely to produce a more polished product and more thorough student engagement. Use of ePortfolios is easily included in professional development and senior capstone design courses, where they are a natural way to present an expanded / illustrated resume or capstone project report. It is more challenging to find authentic approaches to incorporate ePortfolios in courses with specific technical content such as Auburn University does in their heat transfer and fluid mechanics courses. Options include explicitly including some professional development content (and the career version of the ePortfolio) within technical courses, adding a sophomore-level professional development course to the curriculum, or having students build course-specific ePortfolios that focus on the students' mastery of that course's technical content (as opposed to a more general, career-spanning ePortfolio).

Website software platforms: Several factors should be considered in choosing ePortfolio website software including cost, security, flexibility, and long-term availability. Some commercial sites are free. Other software may be available if one's institution purchases student seat licenses. Weebly.com has a graduated pricing structure with basic use being free but higher monthly premiums ($8 to $25 /month) for more storage, no ads, advanced site statistics, password protection, HD audio and video, and more. Wix.com also has a graduated pricing structure with basic use being free but higher monthly premiums ($5 to $25 /month) for more bandwidth, storage, no ads, and more. WordPress.com has similar pricing from the basic free site to varying levels of premium service for $2.99 to $24.92/month. The U.OSU.EDU version of WordPress is multi-site WordPress installation hosted by EduBlogs, funded by a university-wide license, and free to members of the Ohio State community. Portfolium is a product targeted to academic audiences that includes an online portfolio that is linkable to the institutions' Learning Management System (LMS) and Student Information System (SIS). It is free to students and alumni of participating universities, and it is searchable by registered employers. In 2017, OSU's College of Food, Agricultural, and Environmental Sciences chose Portfolium as their ePortfolio platform.

Faculty buy-in: Faculty buy-in is essential for the success of a program-wide implementation of ePortfolios. Assessment data and industry advisory board input can be used to build a convincing case. One model that can work is to have early adopters add ePortfolios first to their program's professional development course, then mentor other faculty to consider using ePortfolios in their courses. Team-teaching and team-grading can also help lower barriers to adoption. Rubrics, such as the one presented in this paper, can speed the grading process. Use of student peer reviews can

also provide students with early feedback leading to improved final products, and easier grading of those final products.

Student buy-in: Students are often motivated by the potential of being noticed by their top choices of employers. Faculty can describe how ePortfolios can help students stand out to recruiters, and can provide an engaging way to explain what biological and agricultural engineering is to companies that may not have experience with our majors. For some students the process of building an ePortfolio was uncomfortable and required additional instructor support. Although this was a minority of the students, the reasons for their discomfort should be addressed. These include students who already have a firm post-graduation plan (e.g., job offer in hand, graduate school or professional school acceptance in place). It also includes students who think they have already established a professional online presence (e.g., LinkedIn profile, personal webpage or blog) and don't want to do additional work on another platform. Therefore, it is important to carefully explain to students how and why portfolios enhance learning, to provide an appropriate level of structure in the course assignments, share good model examples, and help students design and implement effective time management strategies by staggering deadlines for the materials across the entire academic term.

In conclusion, the student portfolio is definitely recommended for use in undergraduate biological and agricultural engineering professional development courses. When practical, it is also recommended to implement ePortfolios over an entire undergraduate curriculum, perhaps not in every course, but in selected required courses across a student's academic career. Future research and enhancements could include pre-/ post- tracking of student success in interviewing and job-hunting skills, employer surveys and focus group discussions, and a quantitative comparison of the various ePortfolio software platforms currently available.

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