

Summary

The Bailey Scholars Program is an undergraduate specialization in connected learning at Michigan State University. Bailey faculty desired a selection process reflecting Bailey values, particularly individuals learning in a community yet taking responsibility for their own learning journeys. A self-selection process was designed, and used successfully.

The Bailey selection process *per se* may be adaptable only to programs with similar values. However, the idea of designing a selection process that reflects the values and ethos of the program is likely to be a very important idea with appeal to institutions of higher education which move to include personal and professional development as part of the educational experience.

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The Use of Student Portfolios to Enhance Learning and Encourage Industrial Ties in Undergraduate Education

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Abstract

As educators are increasingly called upon to justify their effectiveness, the connection between educational programs and professional success is receiving greater scrutiny by students and other stakeholders (parents, future employers, etc.). We believe that student portfolios can play an important

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role in strengthening industrial ties, assessing student performance, and enhancing learning. Practicing biological/agricultural engineers and agricultural professionals were interviewed to determine the role of portfolios in industry. Also, examples of portfolios used in industry were collected, such as company technical marketing documents and statement of qualifications packages. Based on these data and on prior work concerning student portfolios, we designed an instrument to document the student's learning process with respect to the connection between educational concepts and their application in industry. This instrument was assigned as a major component of two agricultural/biological engineering courses and an agricultural construction systems management course. We emphasized industrial ties through use of the portfolio and by direct interaction with industrial models and personnel. In this paper we detail the methods for preparing student portfolios and discuss the success of these methods.

Introduction

While student portfolios have long been used to document student learning and mastery in subjects such as art, journalism, language arts, and architecture, their use in agricultural and technical disciplines has been a relatively recent phenomenon with little supporting literature. Panitz (1996) briefly described the use of student portfolios in technical courses at five universities. Nieto and Henderson (1994) used portfolios in an agricultural education course as a means to evaluate student performance. They also discuss evaluation issues regarding portfolios in current literature. Henderson *et al.* (1995) details student portfolio methods to document student learning and accomplishments. Portfolios were used in engineering technology courses to assess student learning (Shackelford, 1996). Christy and Lima (1998) detailed portfolio methods designed to enhance and assess student learning in biological/agricultural engineering courses.

To this point, literature has centered on the use of student portfolios and methods developed for implementing portfolios in the classroom. Olds (1997) presented two approaches to student portfolios: nonselective/working and selective/final. The first type is an archive of all the student's work, while the second is a collection of representative works selected by either the student or the instructor. Shackelford (1996) differentiated among four types of student portfolios: (1) showcase portfolios which document the students' best work, (2) descriptive portfolios which include both completed and works in process, (3) evaluative portfolios which document student mastery of specified skills, and (4) composite portfolios which focus on group process and team accomplishments.

Industry is calling for technically competent entry-

level graduates who possess strong communication skills and a deeper understanding of the culture and constraints of the business world. Likewise, students are demanding more demonstrated relevance between their educational experience and future careers. It is therefore important to incorporate innovative methods in undergraduate education that explicitly strengthen the ties between industry and academia. We have used student portfolios to this end, and also to initiate student-centered learning. The portfolio method encourages students to take greater responsibility for their own learning and makes explicit the life-long nature of education.

Accordingly, the objectives of this study were (1) to apply the student portfolio method to enhance student learning and encourage industrial ties and (2) to evaluate the success of these methods.

Materials and Methods

Student portfolios were introduced in the following courses: Agricultural Engineering (AE) 625: Modeling and design of biological systems; Agricultural and Construction Systems Management (ACSM) 540: Construction Systems; Biological Engineering (BE) 1252: Biology in Engineering. This is the second year that portfolios have been used in AE 625 and BE 1252. Portfolios were introduced for the first time in ACSM 540. The instructors for each course implemented portfolios to enhance industrial ties in a different manner. Descriptions of each approach are detailed in the following paragraphs. Readers are encouraged to consult Christy and Lima (1998) for more specific details regarding portfolio development and design.

AE 625. At Ohio State University, the portfolio method was implemented in this Food, Agricultural and Biological Engineering senior level core course by having each student maintain a selective, evaluative portfolio. The contents of the portfolio were at the students' discretion, but each was required to include a cover page, competency matrix (Christy and Lima, 1998), referenced work examples, and a narrative essay portion. As the students progressed through the levels of learning for each competency topic, they referenced one or more examples of their work, which demonstrated that they had achieved the stated level of mastery. These examples were drawn from completed assignments or any other items a student chose to undertake. All assignments were submitted to the instructor who graded and returned them to the students. Additional competencies could be added by the student beyond those required, as long as these elements could be demonstrated by referenced documentation in the portfolio. The completed portfolio was worth 10-25% of each student's final grade.

The instructor brought in examples of portfolios used in industry for the class to examine. These included

company technical marketing documents and statement of qualification packages. The class was assigned the task of locating similar materials from the company of their choice. Each student was to pick an industry, agency, or engineering service firm and obtain a copy of his or her current statement of qualifications portfolio. This gave students the opportunity to interact with companies in a non-job seeking mode, thus encouraging students to network and to learn more about their chosen career field.

Another portfolio assignment was the narrative portion of the portfolio notebook, which included short essay responses to portfolio self-assessment questions included in each homework set, and a concluding summary paragraph reflecting on the student's overall experience of the course. These short writing assignments (maximum two pages each) allowed the students to evaluate their own performance and learning style, to identify areas of strength and weakness, and to serve as a reminder of what areas to emphasize with prospective employers during future job interviews.

BE 1252. The portfolio method for this freshmen level core course in the department of Biological and Agricultural Engineering at Louisiana State University was nonselective/working and descriptive. The instructor chose the assignments required for the portfolio, but all drafts were included, and the student chose the method to organize and present the material. Self-assessment narratives for selected assignments were required, and a self-assessment narrative describing the students' overall experience with the course and the portfolio was also required. Students were encouraged to include additional thoughts, feelings, and insights gathered during the semester. The final portfolio consisted of a notebook containing assignments, a journal, which the student wrote in regularly to address questions posed in class, and a personal web page containing a resume on the Internet. The portfolio was presented to the student as a means of documenting the student's thought process in identifying her/his motivation for choosing engineering, choosing areas of interest within biological engineering, and learning fundamental concepts involving engineering design. Re-submissions were not required, but encouraged. Portfolios were checked at mid-semester and were evaluated based on completeness, quality, organization, and creativity. The portfolio was worth 30% of a student's total grade.

Industrial ties were encouraged through four assignments: (1) an Internet report; (2) presentations from practicing engineers; (3) the creation of a home page including a resume, and (4) a design project involving direct client interaction. Details for each of these assignments follow.

(1) Students were asked to complete a detailed Internet search on their respective area of career interest and to

address the following points:

- Identify a career subfield of interest
- Describe specific work projects that the student envisions completing as a professional
- Identify trends in the career subfield
- Assess if envisioned projects are compatible with trends in chosen subfield
- Reflect on information the exercise provides
- Assess if biological engineering is the most appropriate major for the student

(2) Practicing biological engineers, including graduates of the department, made several class presentations. Discussions were interactive, as students were encouraged to ask questions pertaining to being on the job as a biological engineer. Students were required to record their observations and experiences in their journals. (3) Each student was required to create and maintain a home page detailing his/her career interests, including a resume. Students were encouraged to use this tool as they interviewed for summer employment. (4) Students were assigned in groups of three to five members to re-design wild animal enclosures owned by local businesses. The students, who offered their services as practitioners, contacted each business. The business owners were asked to serve as clients during the design process. Contact between students and client was accomplished through site visits, and memo, e-mail and phone communication. The semester culminated with students proposing their designs to a panel including habitat enclosure experts and the business owner(s).

ACSM 540. The portfolio method was implemented for this upper level course for the Agricultural and Construction Systems Management major in the Department of Food, Agricultural and Biological Engineering at Ohio State University. Student portfolios were both composite and evaluative in nature. The instructor chose the general assignments required for inclusion in the portfolio, and each student made individual decisions regarding specific area(s) of study and emphasis. Individual portions of the portfolio were a compilation of class assignments dealing with the use of computers in the construction industry, and a research project on an additional aspect of construction management. Also, class members were divided into construction project teams containing 4-6 members. Each team member included in their portfolio a team project proposal, team charter, and a written, illustrated presentation on a construction project chosen by their team. A final team presentation (with appropriate audio-visuals from their portfolios) was made to a mock client at the conclusion of the quarter. In addition, each portfolio included the student's current resume or vita, and both a pre-course and post-course construction management self-assessment. Each student recorded reflec-

tions appropriate to each section of the portfolio. Some students included additional projects in their portfolios that they felt helped to better illustrate their construction management experience. The portfolio was stressed as an important tool for presenting the student's background in construction management to prospective employers. Students were able to expand their portfolios through assistance provided not only by the instructor(s), but also from outside speakers who were technical experts in various aspects of the construction management field. The intent was that the portfolio would be a working document that the student would update as his/her skills advanced. Portfolios were evaluated on the basis of completeness, originality and relevance to the construction management industry. The student's portfolio was worth 40% of the total grade.

Results and Discussion

The instructors and the majority of students in all classes believed that student portfolios were successful in enhancing student learning and encouraging industrial ties. These conclusions are based on student perceptions, comments from industrial personnel, and instructor reflection.

Student perceptions. Many students made comments which indicated that the instructors' goals in implementing student portfolios had been achieved. These students reported that the portfolio helped them organize their materials, plan their study activities, recall the topics covered in the course, prepare for the Fundamentals of Engineering licensing exam, and use as a professional reference. Overall, 75% of the BE 1252 students, 82% of the AE 625 students, and 85% of the ACSM 540 students reported that portfolios enhanced their learning.

Client comments. We collected further assessment data by asking university administrators and practicing professionals to evaluate selected student portfolios completed by the students in each course. All feedback was positive, as this audience reported that portfolios were helpful for students' academic development and job interviewing skills, for employers to better assess student capabilities, and were an important assessment tool for the accreditation of educational programs.

Instructor perceptions. The portfolio requires that students take charge of their learning and encourages self-assessment and reflection. We believe that this exercise is important to provide a rationale for life-long learning and a better sense of the student's chosen profession. We observed a shift toward student-centered learning, and the following benefits not seen in traditional educational approaches: (1) The re-submission and feedback process for portfolio assignments

made quality the ultimate goal and models the experience that students will get in a professional setting; (2) the portfolio helped illustrate how course concepts, self-assessment, and reflection are integrated into the student's chosen profession; (3) Students seemed to gain more confidence in themselves as people and professionals. In general, students demonstrated increased evaluative skill and creativity and became more motivated.

There was some initial reticence with respect to self-assessment and reflection, probably because the students' prior experiences have not involved these approaches. This reticence was raised as a student concern the first time portfolios were used in AE 625 and BE 1252. We observed less initial reticence during the second time portfolios were used, probably because instructors provided a detailed explanation of how the processes of self-assessment and reflection enhance learning.

Summary

Student portfolio methods were designed to enhance industrial ties and student learning. This approach proved successful, since most students in all courses felt portfolios enhanced their learning. We observed that portfolios helped shift the students' emphasis toward quality work, encouraged use of their evaluative and creative skills, and allowed them to take more control of their own learning. We recommend that instructors who use student portfolios carefully explain to their students how and why portfolios enhance learning. Future work will involve interviewing employers and employees to assess the role of portfolios in industry and providing that information to the students as they build their portfolios.

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