

Introducing ePortfolios to Construction Management Undergraduate Students

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Effective communication is one of the essential skills for construction students. This paper describes an innovative model of a professional digital portfolio (ePortfolio) program in an ACCE accredited construction management undergraduate program. The objectives of this ePortfolio program include improving students' communication skills, improving their writing and critical thinking skills, and helping them become more competitive on the job market upon graduating. This program implements ePortfolio into the curriculum by using ePortfolio related project assignments in selected junior and senior level courses and requiring student to have a fully developed and up-to-date professional ePortfolio at the time they graduate. This program uses a student questionnaire survey to assess its effectiveness. The results of the assessment indicate that this ePortfolio program has made some positive impacts to the curriculum and enhanced students' learning experience.

Keywords: Construction Education, Digital Portfolio, ePortfolio, Assessment, Communication

Introduction

Communication skills are increasingly important in construction and engineering in which specific knowledge must be transferred between culturally different and geographically distant groups (Johnson, 2006). One of the key skills for construction management students to succeed in the future is the ability to communicate using various means, such as oral and written language, electronic and visual media, etc. Students usually acquire this skill through traditional or problem-based learning approaches (Jarger & Adair, 2012). However, these approaches have been founded to have limitations.

An ePortfolio is an online collection of digital artifacts—such written texts, drawings, video, oral performances or other media products from their course work — designed to demonstrate students' learning and accomplishments (see Figure-1). In the process of creating paper-based portfolios, the critical problems are inquiries, revisions, storages, and management. However, ePortfolios cover these problems (Barrett, 2010). The process for creating ePortfolios is related to data collection, acquisition, revision, organization, presentation, storage, and accumulation. The process for using ePortfolios must involve information inquiry, application, sharing, and management. Contents for ePortfolios are all-inclusive, such as learning objectives, learning plans, projects, assignments, reflections, handouts, notes, journeys, group discussions, tests and answers. Furthermore, results for self-assessment, peer assessment and feedback, and teacher assessment and feedback are also included (Barrett, 2010; Chang & Tseng, 2011; Fernandez & Illera, 2009). For ePortfolios, the information is not only general data, but also is useful information, such as handouts, notes, tests, and answers, which are all worthy knowledge. Although projects, assignments, reflections, group discussions, peer assessment and feedback, and teacher assessment and feedback can only be general data and information, after a systematical management, reorganization, and accumulation, they can probably become useful knowledge (Chang, et al, 2014). A professional ePortfolio is a type that displays student work collected throughout their plan of study specifically to an employer audience.

According to the process of using ePortfolios, knowledge accumulation integrates new acquired knowledge with existing knowledge and then stores it into a form that can be comprehended easily and retrieved in the future. Learners can reserve knowledge for applications in the future by the process of knowledge acquisition, integration, storage, and accumulation. These4 four constructs of knowledge amassment can probably be experienced during the use of ePortfolios (Chang, et al, 2014).



Figure-1: What is an ePortfolio? (Garrison, 2013)

Auburn University is a member of the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). As part of the reaffirmation process, SACSCOC asks each institution to develop a plan that arises from the institution's ongoing, integrated, institution-wide planning and evaluation process. The Quality Enhancement Plan (QEP) describes a carefully designed and focused plan of action that enhances student learning or the environment supporting student learning. (SACSCOC, 2014) To prepare for SACSCOC's reaffirmation visit of 2014, Auburn University identified as its QEP a campus-wide project to enhance student learning through professional ePortfolios in 2012. This project is housed in the Office of University Writing. As stated in Auburn University's QEP plan 2012 – 2018 (Auburn University, 2013), "Professional ePortfolios are both a learning process and a product that demonstrates learning. As a process, they engage students in assembling artifacts from across an academic career and other experiences – and in revising and contextualizing these artifacts to demonstrate for a specific audience the themes in their learning experiences. This process enables students to think deeply about their learning, to choose evidence from the many learning experiences they have documented, to revise specific artifacts, and to find connections among their experiences, interests, and aspirations. As a product, professional ePortfolios offer evidence of learning and capacity for graduate study or employment. Though involving web-based technology, the heart of Auburn's ePortfolio Project is the additional learning that happens as students revisit and reconsider the evidence of their learning experiences and present that learning to a real audience as they near graduation."

The McWhorter of Building Science (BSCI) at Auburn University has an ACCE accredited undergraduate program. BSCI faculty members had been actively involved in the university's QEP development process and obtained the knowledge of ePortfolios' benefits in higher education. They came back and presented a proposal to the faculty on implementing an ePortfolio Program in the School and participating in the university's ePortfolio Project as one of the first "cohort" members in fall semester of 2012. This proposal was approved by the faculty. The objectives of implementing and promoting professional ePortfolios in BSCI's undergraduate curriculum include:

- Improving students' effective communication. Students use their ePortfolios to demonstrate their ability to communicate through a variety of artifacts and the multi-media form, with a range of audiences.
- Improving students' writing and critical thinking through reflection. Students use their ePortfolios to present the writing skills and critical thinking by synthesizing their learning and experiences across multiple courses and activities.
- Improving students' employability. BSCI students have a new platform for the demonstration of their learning at Auburn Building Science and professional experiences specifically to future employers, which may make them more advanced in the competition with students from other construction programs.
- Providing faculty scholarship opportunity. BSCI faculty members involved in the program develop scholarly projects connected to ePortfolios, including making scholarly publications and applying for grants.

BSCI faculty members involved in the ePortfolio program have attended relevant conferences and workshops. They have been active with ePortfolio related activities on Auburn campus, such as presenting their experience at workshops, serving on committees, etc.

BSCI also reached out to industrial professionals for their opinions of adding ePortfolios into the curriculum. Faculty members presented the ePortfolio program plan to their Industrial Advisory Council during a meeting in fall of 2012, and received very encouraging responses. See Figure-2 for survey result of BSCI Industrial Advisory Council members' perceptions of the ePortfolio program in the undergraduate curriculum.

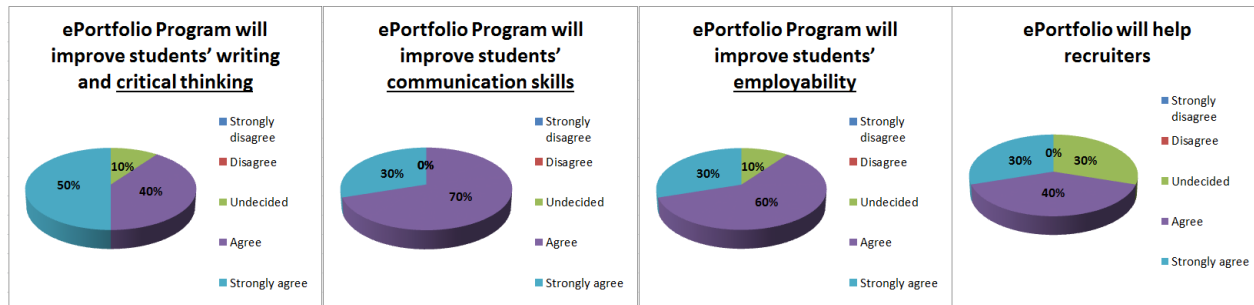


Figure-2: BSCI Industrial Advisory Council members' perceptions of the ePortfolio Program

The objective of this paper is to present the planning, implementation and assessment of this professional digital portfolio (ePortfolio) program in Auburn Building Science's undergraduate curriculum.

Implementation of Professional ePortfolio Program

Program Development

A three-member BSCI ePortfolio Faculty Committee was formed in summer of 2012. The committee developed and launched the undergraduate ePortfolio Program plan in the fall semester of that year.

		<u>Junior Year</u>			
BSCI 3420 Structures for Builders II: Wood, Steel & Temporary Structures	4	eP.-1	BSCI 3430 Structures for Builders III: Soils and Concrete	4	eP.-2
BSCI 3600 Project Controls I	4		BSCI 3650 Project Controls II	4	
BSCI 3500 Construction Information Technology	4		BSCI 4700 Mechanical Systems in Buildings	3	
MNGT 3810 Principles of Management	3		ENGL 3040 or 3080 Business or Technical Writing	3	
BSCI 3700 Construction Safety	2				
Total	17		Total	14	
		<u>Senior Year</u>			
BSCI 4750 Electrical Systems in Buildings	3	eP.-3	BSCI 4850 Construction Law and Risk Management	3	eP.-4
BSCI 4600 Project Controls III	4		Business and Management Elective ²	3	
BSCI 4601 Project Controls III CIT Lab	1		BSCI 4990 Thesis	4	
BSCI 4800 Contracting Business	4		Construction Management Elective ⁴	3	
Construction Elective ³	3		UNIV 4AA0-AR1 Undergraduate Graduation	0	
Total	15		Total	13	

Figure-3: Courses selected for the ePortfolio programs in the last 2 years of BSCI undergraduate curriculum

This program plan proposed all Building Science students to develop a professional ePortfolio and use it to present and reflect on their course work and learning experience. The ultimate goal was to include ePortfolio in all the BSCI courses eventually. However, being at the early stage of implementation and due to the lack of experience on the subject matter, the committee decided to require students to submit ePortfolio related assignments in only one

course per semester in the junior and senior class years. These courses were selected with the considerations of 1) richness of the multi-media artifacts that can be generated from students projects/assignments; and 2) continuation of developing and revising the ePortfolio by students, at-least once a semester in their junior and senior years. The first class to expose students (in their semester-5 of 8 at BSCI) to ePortfolios is BSCI 3500 – Construction Information Technology. Students taking this class begin developing their professional ePortfolios and start the process of reflecting on their experiences and adding artifacts through ePortfolio assignments for the courses in following semesters until they graduate. See Figure-3 for the last two years of Building Science undergraduate curriculum and the courses selected by the committee to have the ePortfolio assignments. Although students are only required to have ePortfolio related assignments in the courses of their last two years in the program, new BSCI students are still introduced to ePortfolios during their orientation and asked to start collecting and archiving artifacts of their course works for ePortfolios in the future.

ePortfolio Project Assignment

BSCI faculty members have developed new project assignments that involve ePortfolios. See Table-1 for details of these assignments.

Table-1: ePortfolio assignments details and courses related

Course Number & Name	Year	Semester	Mandated eP. Project?	Description of ePortfolio Assignment
BSCI 3500-Construction Information Technology	Junior	1 st	Yes	Students develop individual professional ePortfolios as one project assignment, and use it again at the end of the semester to present their course final projects
BSCI 3430-Soil and Concrete	Junior	2 nd	Yes	Students use ePortfolios to report their learning experience of a concrete service learning project
BSCI 4600-Project Control 3	Senior	1 st	Yes	Students use ePortfolios to present a construction schedule and report their learning experience
BSCI 4990-Capstone Thesis	Senior	2 nd	Optional	Students use ePortfolios to demonstrate their overall knowledge, ability and learning experiences at AU Building Science
Study Abroad Program	any	any	Optional	Students create a travel ePortfolio and update it during the trip abroad

Capstone thesis is required in BSCI's undergraduate curriculum. Ten percent of the required thesis work is "student selected" which means students have their own freedom to dedicate about 40 hours of work to enhance their theses. Historically, in-depth temporary structure design, brief BIM model, photos of the complete buildings are among the most common "student select" works. In the spring of 2014, the first BSCI cohort who had completed all four semesters of the ePortfolio program was given a new option of "student selected" work described as "using the ePortfolio to demonstrate their knowledge, ability and learning experiences in the Auburn Building Science program". This project asked students to 1) refine the existing artifacts posted on their professional ePortfolios previously, and 2) add new artifacts associated with the capstone thesis. Detailed requirements of this ePortfolio assignment for thesis are shown below.

Project Objective: The purpose of this work is to allow you to use your ePortfolio: 1) to reveal your construction skills, knowledge and experience; 2) to share your own Auburn Building Science learning experience with others; 3) to showcase your writing and communication skills; and 4) to improve your employability through this online professional representation of yourself.

Detailed Requirements:

- Access and update your existing ePortfolio. Make necessary revisions and updates.
 - a. Revise or reform the structure of your ePortfolio, using a proper navigation to demonstrate your learning experience at Auburn, and your construction related skills and abilities.

- b. Recreate your homepage to talk about your experience at AU, list your main skills and qualifications, and address your professional career expectation.
- c. Use appropriate artifacts collected from coursework, service learning projects, student competitions, internship, etc., to showcase your accomplishments.
- d. Consider to reflect and connect a set of artifacts that are on a specific subject and have been collected through various phases of your co-curriculum, to reflect the growth of your knowledge on that subject.
- Create a new section in your ePortfolio, and title it “My Thesis”.
 - a. Develop a homepage for your undergraduate capstone thesis.
 - i. Why did you choose this building/project for your thesis?
 - ii. How did you obtain the design and construction documents?
 - iii. Brief introduction and highlights of the building project.
 - b. Develop other pages to show at least five items of your thesis, one page per item respectively. Each page should include the following contents:
 - i. Description of the item. How was it created?
 - ii. Appropriate types of media of the item. For instance, a high-resolution screen shot of the construction schedule, photos or diagrams for structural analysis, a walk-through video for a 3D model, etc.
 - iii. A link for visitors to download the original file of the item
 - c. Create another page to reflect on your thesis experience and list the lessons learned.

Out of 34 students in the spring 2014 thesis class, 21 chose ePortfolio as their “student selected” work, which was very encouraging for the program.

Program Assessment

BSCI’s ePortfolio program is assessed on both course level and program level.

Course-Level Assessment

For each course’s ePortfolio project assignment, the program has developed a grading rubric based on the guidelines recommended by the university. Besides incorporating specific course-related contents, the grading rubrics also evaluate ePortfolios according to four general learning outcomes, including 1) effective communication, 2) critical thinking through reflection, 3) technical competency, and 4) visual literacy. The jury team of the ePortfolio programs is normally consisted of the course instructor and a faculty member of the ePortfolio Committee. Figure-4 shows a sample of grading sheet used to evaluate the thesis ePortfolio.

	Minimal Evidence (Novice)(1 point)		Moderate Evidence (Developing)(2 points)		Substantial Evidence (Professional)(3 points)	
	<i>Jury-1</i>	<i>Jury-2</i>	<i>Jury-1</i>	<i>Jury-2</i>	<i>Jury-1</i>	<i>Jury-2</i>
Effective Communication						
Critical Thinking Through Reflection						
Technical Competency						
Visual Literacy						
Total Score: Jury-1: ___/8	Jury-2: ___/8		Avg.: ___/8			

Figure-4: Thesis ePortfolio grading table

Program-Level Assessment

BSCI also evaluated effectiveness of the ePortfolio program at the end of the spring of 2014, through a survey with the first student class that had just gone through the entire ePortfolio program and completed their thesis ePortfolios.

This survey consisted 17 questions, mostly multiple-choice type and being focused on collecting students experience and perceptions of having ePortfolio in their curriculum. Among 34 students of the fall 2014 thesis class, 30 participated in the survey during their exit interview with the School Head. 29 responses were valid and only one response was incomplete therefore excluded. Due to the page limit, this paper only presents the results and discussion of select questions in the survey.

Students' General Experience of Having ePortfolio in the Curriculum

The first six questions of the survey were used to collect general information of having ePortfolio in the undergraduate curriculum. It was indicated that the three courses that generate the most artifacts for students' ePortfolios are: BSCI 4990 - Capstone Thesis (72%), BSCI 3600 - Project Controls 3 (52%) and BSCI 3430 – Soil and Concrete (45%). The university has recommended four ePortfolio platforms, including Wix, Weebly, Wordpress and Google Sties. All these four platforms are free-of-charge website builders and do not require any programing or computer language knowledge for the users. The majority of the BSCI students selected WIX.com (59%) or Google Sites (38%), and the other two platforms were used by only one student each. This reflects that the ease of use and ability to customize are the key factors for BSCI students to pick an ePortfolio platform. About one half (52%) of the students have spent from 10 to 25 hours total on developing their ePortfolios, one third for more than 25 hours, and 14% for 10 hours or less. This result does not include student's time spent on generating the artifacts that have been used on their ePortfolios.

Surprisingly, only 3 students (about 10%) have actually used ePortfolios during their job hunting. One of the objectives of implementing ePortfolios in the curriculum was to provide BSCI students advantages over a conventional resume and make them more competitive on the job market. However, most graduating students had already had job offers even before starting their theses, therefore they did not have to use ePortfolios for job hunting. Auburn University's Office of the University Writing have made a significant amount of the resources available to the students to help them learn and develop professional ePortfolios, including training classes, workshops, seminars and online tutorials. One half of the respondents have used these resources, which may be explained by that only four students of the whole class have had technical difficulties while developing their ePortfolios. The ePortfolio lectures in their Construction IT class and ease of use of the university-recommended open-source ePortfolio platforms have also been helpful in preventing technical difficulties.

Effectiveness of Using ePortfolio to Improve Students' Communication Skills and Learning

When asked if ePortfolio assignments have improved their writing, critical thinking through reflection or communication skills, most respondents gave a negative or neutral answer, see Figures 5, 6 and 7 for the distribution of the answers to these questions. However, even if there have been such improvements, it was very hard to quantify them through a survey, or students may have yet to realize these improvements. On the other side, these ePortfolio assignments have given BSCI students opportunities for practicing their writing, communication and digital-literature skills on a web-based platform. These types of exercises were rarely available in BSCI curriculum before the ePortfolio program started.

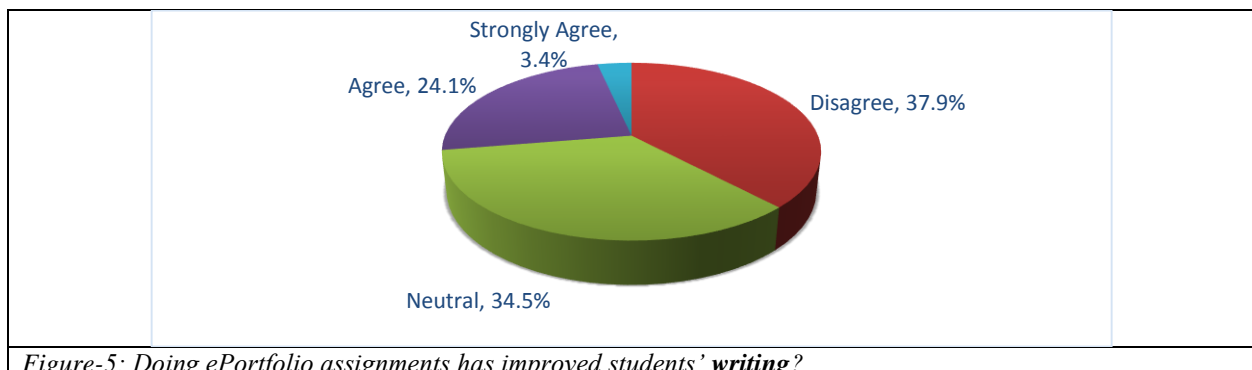
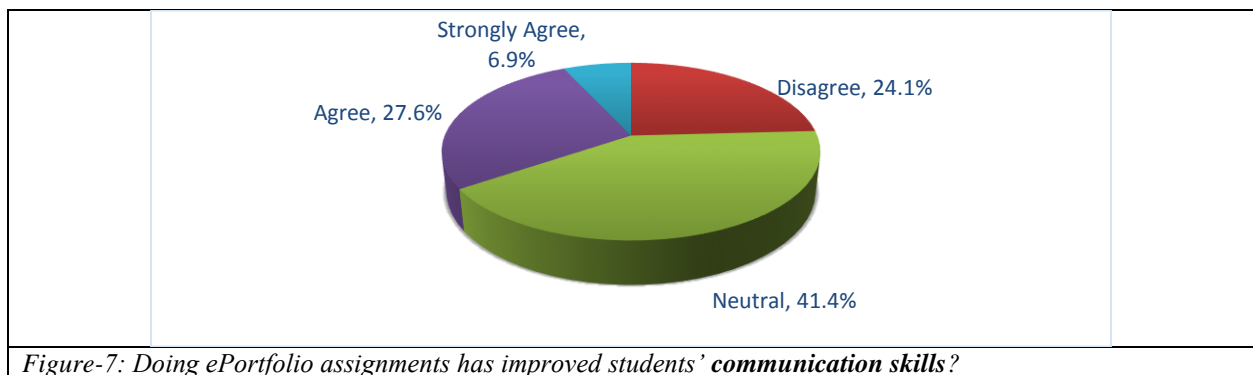
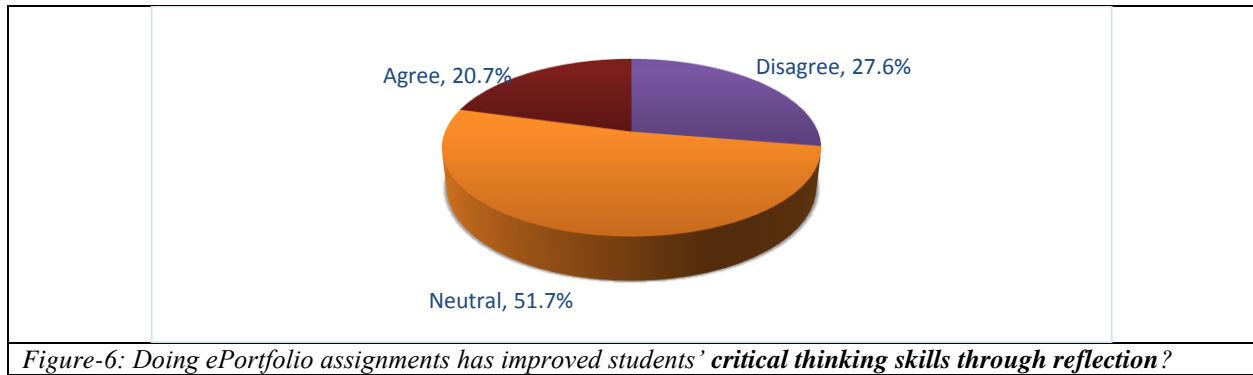


Figure-5: Doing ePortfolio assignments has improved students' writing?



Although only four students in the thesis class have used ePortfolio for their job hunting, most students (58%) agreed or strongly agreed that “a good professional ePortfolio can help BSCI students present their knowledge, skills and abilities better than a conventional resume”, and only less than a quarter of the class disagreed with this statement. This result shows that our students are positive with the idea that an ePortfolio has advantages over a conventional resume and can make them more competitive on job market.

In general, students had a good experience with the ePortfolio program. About one half of the thesis class has enjoyed the process of developing and using their ePortfolios, and less than one quarter of the class has not. When asked if they would use or adapt the ePortfolios that they have created in BSCI courses in the future, more than 40% of the students said “yes”, and 30% said “no”. Because all the ePortfolio platforms used by the students are open-source websites and not bounded with the university, students can continue the development on the ePortfolios even after they graduate and easily transfer them into their career ePortfolios.

Conclusion

Communication is one of the key skills for construction management students. An ACCE accredited construction management program developed a professional ePortfolio program in its undergraduate curriculum, with the intention of improving its students' effective communication, writing skills and employability, and providing more scholarship opportunities for its faculty. This program has been implemented by requiring students to collect artifacts in selected courses in their junior and senior class years, and then reflect and post the artifacts on their ePortfolios as assignments of these courses. Through the assessments at both the course-level (ePortfolio assignment grading rubrics) and program-level (a student survey), it seems that the ePortfolio program has made positive impacts to the curriculum and enhanced students' learning experience. Some of the specific positive findings include:

- Students have quickly accepted the addition of ePortfolio in their curriculum. They have not had too many technical issues with the development of their ePortfolios because of the ease of use of the platforms and recourses provided by the School and University.
- Most students have realized the advantages of ePortfolios over the conventional resume

- Most students have enjoyed the process of developing and using their ePortfolios in classes and many of them plan to keep their ePortfolios after they graduate and maybe transfer them into their Career ePortfolios.

Because this is the first ePortfolio program for this construction program and also new to the University, there have been some issues encountered through implementing the ePortfolio program:

- Two of the ePortfolio Program's main goals, 1) to improve students' students' effective communication and 2) to improve student's writing and critical thinking, have not been reflected from the assessments. Many students did not realize the unique opportunities that the ePortfolio Program has provided them to enhance their learning experience. Also, the faculty are still trying to figure out a method to assess students' improvements in some areas
- Most students did not use ePortfolio during job hunting. The faculty members believe this was due to the strong demands for graduates and many BSCI students in this class have already had job offers before they graduated.
- It has been challenging to motivate more BSCI students and faculty members to participate in the program. Making students more employable with a good professional ePortfolio is a big sales-point to most disciplines. However, for many BSCI students, with plenty of employment opportunities available, they can easily secure a job before they graduate, so they don't have great interests to use their ePortfolio. For many faculty members, without enough understanding of the learning and teaching benefits offered by ePortfolios, they just see this ePortfolio Program as "another thing" to do and are not willing to participate.

In order to overcome these obstacles and achieve the full goals of the ePortfolio Program, the authors plan to take the following actions:

- Educate students and faculty members to make them aware of the advantages of ePortfolios,
- Develop a more comprehensive assessment system in the curriculum to track students' progress with ePortfolios and measure the effectiveness of the Program,
- Promote ePortfolios to college recruiters, and ask for their help to encourage students to use ePortfolios.

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