International Journal of ePortfolio
http://www.theijep.com

2012, Volume 2, Number 1, 87-97
ISSN 2157-622X

Implementing ePortfolios for the Assessment of General Education Competencies

Gail Ring
Clemson University

Barbara Ramirez
Clemson University

This paper describes the Clemson ePortfolio Program initiated in 2006, where all undergraduate students are required to create an ePortfolio. Specifically, the program was designed as a mechanism through which to evaluate our recently revised general education program. In this program all undergraduates create and submit a digital portfolio as evidence of academic and experiential mastery of our general education competencies. This paper, which is the first in a series, describes the implementation process providing a detailed look at the rationale behind implementation, feedback and mentoring, assessment, and support.

The purpose of this paper, which is the first in a series, is to examine the ePortfolio Program as implemented at our University as a multi-purpose environment, one in which students learn about themselves as learners through what Schön (1983) termed reflection in action and on action and a second in which our University learns about the effectiveness of our core competencies instruction and our student's ability to demonstrate them.

The Clemson ePortfolio Program was implemented out of a need to evaluate our recently revised general education program. In this Program, all undergraduates create and submit a digital portfolio as evidence of academic and experiential mastery of our general education competencies. Its rationale is to build a mechanism through which core competencies (see Appendix B; e.g., Arts and Humanities, Cross-Cultural Awareness, Mathematical Literacy, Natural Sciences, Social Sciences, Science and Technology in Society, Critical Thinking, and Ethical Judgment) can be both demonstrated and evaluated.

It is through the development of their ePortfolios that students begin the process of self-reflection as they select appropriate work and analyze these selections, engaging in connection making and synthesis as they bring their evidence together to tell their academic story. These activities require students to engage in critical reflection of learning. This self-assessment or examination of learning is powerful and contributes to the habits of mind that we wish to embed in our students. Moreover, key factors in the development of an ePortfolio are student selection and reflection on the elements to be included, ideal activities to support the new learning outcomes-based approach to general education.

Our Program has several benefits for its stakeholders. They include:

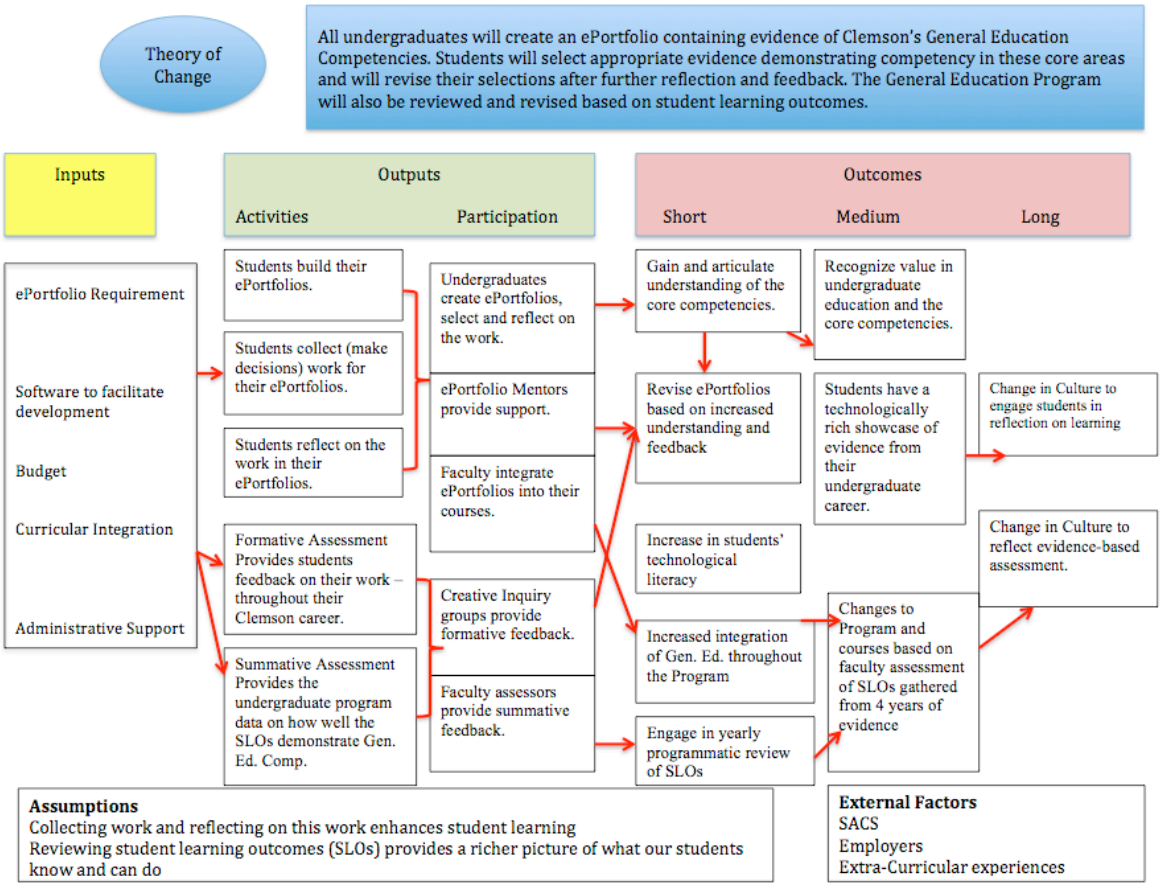
- Encouraging students to reflect on their learning;
- Helping students to see how their coursework relates to real-world practice;
- Helping students to see the inter-connectedness of general education and upper-level courses;
- Helping students to recognize how their college experiences connect to their professional goals;
- Offering a flexible yet robust assessment system that provides a way to aggregate and disaggregate data for university, college, and departmental use;
- Offering a student-centered way for measuring learning outcomes while encouraging deep learning and student engagement;
- Allowing both faculty and students to evaluate student growth, making learning visible to both students and faculty; and
- Providing a mechanism through which students can showcase their knowledge and skills that can be used for internships, employment, or graduate school.

A logic model was created to chart the Theory of Change that the ePortfolio Program might facilitate. Figure 1 maps the flow of inputs, outputs, and outcomes of this implementation, thus acting as the blueprint for change. The Program brings together resources in the form of mentoring, peer feedback, and technological support to all stakeholders (faculty, students, and administration). This paper is divided into sections that mirror this logic model from its implementation (inputs) to its results (outcomes).

Theoretical Framework

The use of electronic portfolios in higher education has increased steadily over the past decade. Not surprisingly, these initiatives seem to be commonly focused on a single program area such as education, architecture, or writing and are put in place for a variety of purposes, usually focusing on learning, assessment,

Figure 1
Logic Model: Theory of Change



or showcasing skills and achievement (Abrami & Barrett, 2005). We believe it is imperative that these goals co-exist. That is, unless students see value in creating an ePortfolio, it will be viewed as an add-on and, as a result, will not include quality evidence that will provide an accurate assessment of student knowledge and abilities. Therefore, the purpose of our current ePortfolio Program is a combination of learning, assessment, and showcasing of student work. Students are encouraged to collect evidence, reflect on this evidence through the construction of a rationale statement justifying the relationship between the artifact and the competency, and begin to reflect on how this evidence "showcases" their professional skills. We believe that a successful ePortfolio program incorporates these various forms at strategic times throughout a student's education. In addition, student ePortfolios facilitate our task of institutional goal setting and enhance our general education curricula.

Although the primary purpose of the Portfolio Program is the assessment of general education, its development requires students to make decisions and to think critically about what evidence is appropriate. This activity encourages students to engage in critical self-reflection and critical narrative analysis (Moss, 2003, 2008), aligning well with our goal of producing lifelong learners. Doing so shifts the focus from a standardized product to one that elicits both creative and critical thinking. It is through the selection of appropriate work and the development of their rationale statements that articulate how the evidence demonstrates the competency that students engage in this critical self-reflection. Since our ePortfolio Program focuses on assessment as a tool for learning, rather than solely as an assessment of learning, we believe that multiple goals can be achieved.

ePortfolios for Learning

Paulson, Paulson, and Meyer (1991) view the ePortfolio as a laboratory where students construct meaning from their accumulated experiences. According to them, it is a story of knowing backed by evidence. For a learning ePortfolio, students

demonstrate what they know using evidence collected from their various college experiences. This activity engages students in self-reflection as they begin to examine their own learning and development. This learning process is augmented through systematic reflection, identification of learning, and the synthesis of evidence accompanied by the identification of learning gaps (Borman & Dowling, 2006).

An ePortfolio Program that has at its core learning and approaches this goal from a student-centered perspective must have a built-in mechanism for feedback. This mechanism is difficult to implement because as Wade and Yarbrough (1996) point out, student feedback and ePortfolio review require a significant amount of time. Although researchers agree that reflection on learning is a critical element of the portfolio process, they also have pointed out that students are not good at constructing well thought-out reflective statements, concluding that scaffolding is essential for this process (Carraccio & Englander, 2004; Ring & Foti, 2006). The most effective and successful ePortfolio programs provide formative feedback throughout the ePortfolio development period, encouraging reflection and subsequent revision and refinement of the evidence. We believe it is through this formative review and students' subsequent reflection on that feedback that they begin to identify and achieve their learning goals, better understand their strengths and weaknesses, and begin to recognize the intrinsic value of their ePortfolios. This process has begun to inform our Portfolio Program and has contributed to a richer assessment of our core competencies.

ePortfolios for Assessment

The increased use of ePortfolios for assessment has changed the nature of the ePortfolio discussion, often contributing to tension in the ePortfolio community. Recently, there has been a tendency to use portfolios in accountability-driven assessment systems in many countries (e.g., England with teacher standards, the USA with state licensing of teachers and Australia with outcome-based education) to determine standards of performance or competency levels in these settings (Cochran-Smith & Fries, 2002; Darling-Hammond, 2000). The assessment portfolio is often implemented for bureaucratic use and has mandated requirements (Smith & Tillema, 2003). Many view these issues as possible contributors to the disconnect between assessment criteria and student learning, thus creating a conflict between the measurement of standards and capturing development and reflection (Smith & Tillema, 2003). According to Zeichner and Wray (2001), there is also a tension between a student-centered and an overly prescribed ePortfolio that may cause students to resent it, thus contributing to a lack of ownership or buy-in on the part of students. To address these tensions and facilitate the student learning and analysis crucial to developing 21st Century skills, Clemson is attempting to implement an ePortfolio Program that extends beyond a department or college and is integrated throughout the undergraduate curriculum.

Inputs

Implementation

In an attempt to prepare students as lifelong learners in a rapidly changing world, our general education curriculum underwent substantial changes in the competencies of the core curriculum in 2005, expanding to include technological literacy, ethical judgment, cross cultural awareness, critical thinking/problem solving, and STS (science and technology in society). Given the new laptop requirement for undergraduates, it became evident that an effective way to evaluate student understanding of these core competencies was through the development of an ePortfolio. Key factors in the development of such a portfolio are student selection and reflection on the elements to be included, activities supporting the new learning outcomes based approach to general education. Moreover, electronic portfolios are a way to generate as well as document learning (Basken, 2008). A taskforce comprised of faculty, staff, and students was convened to explore the idea of an ePortfolio requirement, and a formal proposal outlining ePortfolio development, support, and assessment was subsequently presented to the undergraduate curriculum committee who voted to implement the program. These topics are discussed in detail in the upcoming sections.

In 2007, a director was hired to oversee and manage the Program. During her first year, she collected data from students and faculty via surveys and face-to-face conversations to gain a better understanding of the ePortfolio Program. Based on this feedback, it was clear that several issues needed to be addressed, including:

1. Overall confusion and misunderstandings regarding the ePortfolio Program;
2. Limited support available to students;
3. A lack of exemplars available upon which students could model their work;
4. A lack of motivation on the part of the students to create their ePortfolios; and
5. Uneven integration of the ePortfolio throughout the undergraduate curriculum.

These issues became the foundation upon which our support system is based and provided the impetus for

the redesign of elements of the Program. This process has become iterative as we continue to identify issues/problems related to the ePortfolio Program and correct them as they occur.

Tools Used

Working under the guidance of the Information Technology Department, the faculty taskforce developed a plan for students to use the current course management system to create their ePortfolios. We continued to use this system for the first two years of implementation at which point it was deemed insufficient to meet the needs of our Program and our students. For example, students wanted more flexibility in the design of their ePortfolios, and when surveyed, stated they would prefer to use Google, iWeb, or simply build their own pages using a web editor. Though this range of development tools presented a problem for us in terms of implementation, training, and assessment, we learned that there was no "one-size fits all" system that would provide students the flexibility they desired while providing us the ability to assess their work and collect data on this assessment. We decided at that point to use two systems, one for the ePortfolio interface (see Appendix A) and another through which students tag (connect digital evidence to a competency) their work and assessors review the work (see Appendix B).

Simultaneously, the University adopted Google Apps, meaning that all students were provided a Gmail account and had access to Google Docs. This made it easy for us to adopt GoogleSites as an ePortfolio tool. It is important to point out that while we encourage students to use GoogleSites to develop their ePortfolios, they are not required to do so. They are, however, required to use CUePort to tag their work to the competencies.

This tagging/assessment system was developed in-house and is multi-purpose. Using CUePort, students tag evidence to the general education competencies, peers review their work and provide feedback, and faculty assess the work for programmatic improvement.

Another problem we had with our original system was its lack of portability. In other words, once a student graduated they could no longer access their ePortfolios unless they downloaded a copy prior to graduation, a cumbersome process. We believe it is our responsibility to support and encourage lifelong learning in our students and that our students should have access to their ePortfolios well after graduation. Google and CUePort allow for this portability and accessibility beyond graduation. In fact, we already see evidence from Google Analytics that some students are continuing to use and revise their ePortfolios after graduation and will continue to collect data to learn the extent of students' use of ePortfolios in this context.

Faculty and Student Support

Based on concerns voiced by faculty and students in informal conversations with the Director of the ePortfolio Program during her first year, Clemson initiated the following suggestions over the next two years to enhance faculty and student support:

- Deepen student understanding and buy-in through ePortfolio student mentors, student workshops, and online support;
- Deepen faculty understanding and buy-in through ePortfolio workshops, brown bag lunches, and informal visits to student advisers;
- Provide ePortfolio exemplars that serve as best practice examples for faculty and students;
- Implement an ePortfolio campus-wide awards program;
- Continue to survey students to identify student perceived weaknesses of the program and revise the program based on these data; and
- Continue to identify the issues related to the ePortfolio system and correct problems as they occur.

We found that providing students a variety of learning opportunities "just-in-case" they will need it – though we know they will – as well as "just-in-time" opportunities provides maximum support. Some examples of "just-in-case" learning opportunities include online tutorials available through the ePortfolio website (http://www.clemson.edu/academics/programs/eportfolio/index.html), workshops, and in-class visits. The "just-in-time" opportunities include ePortfolio mentors available for face-to-face or virtual assistance and faculty-developed prompts embedded on the tagging page that pose probing questions designed to help students make appropriate choices of work. We have also made significant efforts to deepen faculty understanding and buy-in through ePortfolio workshops, brown bag lunches, and informal visits with student advisors.

In addition, we recently implemented a common freshman experience, LIB100, in which students learn how to use technology at the University, engage in diversity training, and begin their ePortfolios. In this zero credit class, students watch two video modules designed to help them create their GoogleSites page and tag a practice artifact. In this class, we also try to help them understand that keeping their work is an important part of their college experience, providing them an opportunity to step back and reflect on their Clemson experiences, though admittedly, it is believed that few actually comprehend this idea as freshmen.

Many students are resistant to the idea of an ePortfolio initially, yet we find, not surprisingly, that the sooner students begin the ePortfolio process and the more frequently they revisit their ePortfolio, the more value they recognize from it. Students begin to gain a sense of accomplishment when provided an opportunity to review and reflect on their collegiate experiences.

Outputs

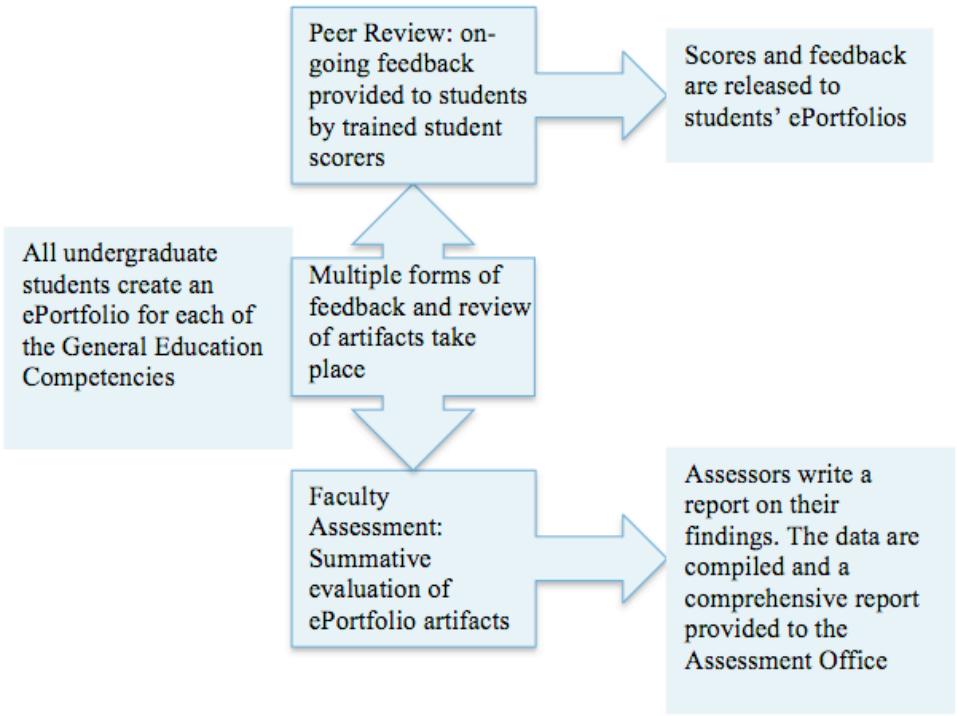
ePortfolio Assessment

Once students choose and tag their work, the assessment process begins. In our program, multiple forms of assessment were implemented based on recommendations from the ePortfolio faculty taskforce and the Clemson University Office of Assessment. According to the Southern Association of Colleges and Schools (SACS), a sound rationale must be in place to evaluate undergraduate general education (see Figure 2). To address this expectation, the ePortfolio faculty taskforce conceptualized a robust assessment plan utilizing multiple sources of feedback and artifact review including self-assessment, peer feedback (formative assessment) and faculty assessment (summative assessment). Feedback from professors and peers is an essential element of ePortfolio development. Moreover, using the ePortfolio as a catalyst for dialogue contributes to new ideas, new learning and broader thinking. In the 21st Century, courses and grades are simply not enough!

This reasoning is supported by research which suggests that portfolio assessment provides multiple benefits for both the developer and the institution in the form of valid, holistic assessment of students higher-order cognitive skills (Dickman, Schwabe, Schmidt, & Henken, 2009), improvement of students' ability to self-assess and reflect on their work (Gilman & McDermott, 1994), and more authentic evidence (Kieffer & Morrison, 1994). As Wiggins (1994) suggests, "the use of a single grade to represent achievement, progress, and growth leads to the difficulty of grading fairly" (p. 33). The following sections address the formative and summative assessments used at Clemson.

Formative feedback. Creative Inquiry (undergraduate research) groups are utilized for the formative feedback of ePortfolio artifacts. Each competency area has a Creative Inquiry (CI) team associated with it, comprised of a faculty facilitator and up to ten students. There are two components to these CI projects: conducting research on ePortfolio related topics and scoring of artifacts. Like all CI projects, students commit to at least one year of involvement, although many have stayed with the team longer. Prior to reviewing and scoring artifacts, students must

Figure 2
Assessment Rationale



complete the Human Subjects modules through CITItraining.org (certificates of completion are retained by the faculty facilitator), participate in a training session conducted by Director of the ePortfolio Program on the technical aspects of scoring as well as more general dos and don'ts of scoring, and participate in a training and norming session conducted by their faculty mentors. Through this process, the students are trained extensively on CUePort, the tagging and assessment tool, the competency and how to review a student's communication skills.

The training approach is fairly consistent among all groups. At the beginning of the semester, the scorers meet with their faculty advisors, and everyone reviews the same artifact using a faculty-developed rubric for the particular competency. The scorers then discuss and compare their scores to achieve consensus. This process usually takes a few sessions and a great deal of conversation before reviewers' scores are consistent across artifacts. The student reviewers are only allowed to score on their own when the faculty mentor is certain they are fully trained.

Once trained, using the CUePort system, students randomly select an unscored artifact based on student year (freshman, sophomore, junior, senior, graduating senior) and competency. Using the rubric developed for each competency, the artifact is scored on 1-4 scale. In many cases, comments are also provided (comments are required for scores of 1 and 4). These are scores – not grades – that indicate how well the work has demonstrated the competency. These scores are retrieved weekly by the Director of the ePortfolio Program and reviewed for anomalies prior to release to the student's CUePort page. Anonymity is built into the system, and for the most part, students are not aware of whose artifact they are scoring.

Summative assessment. Each summer, a cadre of faculty members from various disciplines conducts a summative assessment of student ePortfolios from across campus. We invite faculty to participate based on several factors: college/department, we try to include a cross section of faculty participants from each college; student exposure, we try to include faculty that teach large general education classes (Introduction to Psychology, for example); and a commitment to general education. Each potential participant is sent a list of the eight competencies and is asked to think about which ones he/she feels best suited to assess. Once we have this information, we select our assessors. Initially, we thought the summative assessment could move off-site and be done asynchronously, but it has become clear that working together and sharing ideas and concerns are important parts of the process. We encourage participants to commit to two summers of work, enabling us to have seasoned as well as novice assessors involved and makes the training and overall process function more smoothly. Participants are compensated for their time.

This process is intended to provide insight on the quality of student artifacts, the clarity of the competencies, and the usefulness of the scoring rubrics. Each summer, approximately 1,000 artifacts are scored, and the data are reported to faculty, administration, and the University Office of Assessment.

We approach faculty assessor training the same way we approach training peer reviewers: practice, conversation, and more practice. The first morning, all assessors are trained on using CUePort to assess artifacts, a process that takes approximately one hour. We then achieve group inter-rater reliability by selecting two or three artifacts and scoring them together. This is meant to provide assessors an opportunity to see the assessment process in action and to get in the habit of conversing about the work. Once reliability across all raters is achieved, the groups are adjourned to smaller groups where the same format and process are used to achieve reliability in the competency group.

The opportunity that faculty have to "read" students' ePortfolios enables them to gain a better understanding about what our/their students are learning throughout the undergraduate curriculum. In fact, that is already happening as faculty who participate in the summer assessment have a more favorable view of the ePortfolio and are more willing to integrate it into their classes. The summer assessment has been conducted for four years, and we have used these data to improve the general education curriculum.

Outcomes

The ePortfolio Program, while still in its early stage of implementation, has already had a significant impact on university policy, classroom practice, and technological infrastructure. The outcomes gained from the ePortfolio Program include:

- The ePortfolio is becoming an active part of the dialogue about student learning. Each summer, faculty are actively engaged in reviewing the work that students select to demonstrate the general education competencies.
- Based on the work viewed through the students' ePortfolios, substantial changes were made to the undergraduate curriculum. For example, in 2006-2007, Clemson had 22 competencies; this number was reduced to 19 in Fall 2009, and further reduced to eight in Fall 2010.
- One of the more notable changes that occurred to the competencies pertained to Written and

Oral Communication. We noticed that in some cases students seemed to only pay attention to the quality of their communication for the communication competencies. Moreover, faculty and peer reviewers often neglected to take communication into consideration when reviewing work outside of the communication competencies. This contributed to a silo effect for communication and was distressing for a University known for communication across the curriculum. With feedback from the Communication and English departments and the Pearce Center for Professional Communication, the University Curriculum Committee voted to make communication an über competency, meaning that every artifact in a student's ePortfolio is reviewed for both communication and content. This was a monumental decision and one we hope will help our students become better communicators.

- Although students were provided feedback electronically on the quality of their artifacts, preliminary data suggest that their work began to improve significantly after face-to-face conversations about the purpose of the competencies. Based on these data, workshops were created to help students "unpack the competencies."
- Faculty members have begun to rethink their syllabi and course assignments based on the work that students are including in their ePortfolios. In some cases, courses and assignments have been revised to help students better understand the competencies and how to demonstrate them effectively.
- The ePortfolio technological infrastructure was radically changed to encourage greater creativity and ownership on the part of students. For example, we moved from a closed to an open system (students select how they want to present themselves using GoogleSites or a similar development tool).
- The ePortfolio assessment system was radically changed to facilitate peer feedback and faculty assessment. CUePort was designed by the Director of the ePortfolio Program and a professor in computer science and has been used successfully for three years.
- Multiple entities across campus have become collaborators with the ePortfolio Program. For example, the library has become a center for ePortfolio technology checkout; the Class of 1941 Studio for Student Communication has become the "hub" of ePortfolio training; and the Michelin Career Center has begun to survey businesses regarding the contents of an ePortfolio used in the job search process.
- To raise awareness and reward students, the Program has implemented a campus-wide ePortfolio awards program (10 awards given Spring 2010). These awards help provide ePortfolio exemplars that serve as best practice examples for faculty and students.
- Various student groups have taken ownership of the program. For example, the Transfer Student Council developed a brochure and organized a "blitz" students attend for help on developing their ePortfolios. Various other student groups (sororities, Women in Science and Engineering, etc.) have initiated student workshops and ePortfolio work sessions.

Challenges

To continue our path to success, we must address a few issues that continue to plague the Program: buy-in, clarity of purpose, motivation, and use of technology. One of the challenges of a university-wide program such as that envisioned by the faculty taskforce is how to satisfy the needs of the various stakeholders (students, faculty, and administration). Ideally, the portfolio should become a mechanism through which students see continuous self-growth. This would support the findings of portfolio researchers, namely that as students connect their work to standards, they begin to better understand the standards and see value and relevance in their work (Campbell, Cignetti, Melenyzer, Nettles, & Wyman, 2001; Ring & Foti, 2003).

One of the challenges we faced during the implementation period is getting students as well as faculty to accept the ePortfolio as a holistic way in which students document their learning, understanding, and growth throughout their college experience. Hartman and Calandra (2004) suggested that one of the factors that contributes to the burden students feel portfolio development places on them is the disconnect between their ePortfolios and the assignments in their classes. This finding is supported by data collected from our assessments that suggest some general education classes do not provide opportunities to generate quality artifacts. Moreover, the perception that professors do not value the Program contributes to the lack of value that students see in the ePortfolio activity. Because of this disconnect, in many cases, it seemed as though students were simply "dumping" work into their ePortfolio in an effort to "get it out of the way."

Similarly, a concern voiced by faculty is "what do we need to sacrifice in our curriculum for the ePortfolio?" With proper integration, the answer to this

question is "nothing." Stone (1998) explored the importance of providing guidance and support when implementing teaching portfolios and the efficacy of introducing them early in the professional education program. Stone found that 75% of the group who received support near the beginning of their first student teaching experience believed that portfolios accurately communicated and documented learning and accomplishments while 48% of the participants, who began portfolio construction with their final student teaching assignment, agreed that portfolios were worthwhile. Stone (1998) concluded that students need to be introduced to the process early, that the introduction must be carefully planned, and that students needed to be taught how to select and reflect on their learning. A portfolio is much more than just a collection of student work: it gains value from the thoughtfulness and deliberateness of the selection. In order for the ePortfolio to become a learning environment, students must be encouraged to engage in continuous self-assessment and reflection. That is, the ePortfolio must not be thought of as an add-on; rather, it must be revisited and revised often throughout a student's academic career.

We also found that a lack of clear purpose was a barrier to the success of our program. While the reason for implementation was the assessment of general education, its purpose was not clear. Students thought it was for employment purposes, an idea we in fact used to "sell" them by suggesting their ePortfolios will help them get jobs once they graduate; however, students rightly complain that employers are not interested in Clemson's general education competencies. The reality is that we have an ePortfolio requirement to assess our general education program, and we need to sell it to students by having them see the benefit of creating one. We are still working hard to make clear its purpose to all stakeholders, a problem that is proving difficult to overcome.

Finally, shining a light on what our students don't know is not always popular among both students and faculty. We point out that the ePortfolio is a lens through which we gain a richer picture of our students' understanding of the general education competencies. With this understanding, we are empowered to make the necessary improvements to the undergraduate curriculum.

Conclusion

As we continue to develop long-term implementation plans, the critical lesson learned is that we cannot approach things from one perspective if we are going to be respectful of the university community. In order to achieve this result, we need to encourage students and faculty to think of ePortfolios as a catalyst for reflection or a context for discussion and to facilitate it whenever possible. Ideally, this occurs not at the end of the process but throughout the student's Clemson career. Understanding the importance of this dialogue is critical to the success of the initiative. With time, we hope the University community will see ePortfolios as a forum through which expertise may be developed during the undergraduate years, providing the "value-added" experiences found only in the university setting. Assessment based on ePortfolios then becomes a moving picture, a video stream of achievement, rather than a periodic snapshot (Heritage, 2007).

References

Abrami, P. C., & Barrett, H. (2005). Directions for research and development on electronic portfolios. *Canadian Journal of Learning and Technology, 31*(3).

Basken, P. (2008, April 18). Electronic portfolios may answer calls for more accountability. *The Chronicle, 54*(32), A30. Retrieved from www.chronicle.com/weekly/v54/i32/32a03001.htm

Borman, G. D., & Dowling, N. M. (2006). The longitudinal achievement effects of multi-year summer school: Evidence from the Teach Baltimore randomized field trial. *Educational Evaluation and Policy Analysis, 28*(1), 25-48. doi:10.3102/01623737028001025

Campbell, D. M., Cignetti, P. B., Melenyzer, B. J., Nettles, D. H., & Wyman, R. M. Jr. (1997). *How to develop a professional portfolio: A manual for teachers*. Boston, MA: Allyn and Bacon.

Carraccio, C., & Englander, R. (2004). Evaluating competence using a portfolio: A literature review and web-based application to the ACGME competencies. *Teaching and Learning in Medicine, 16*(4), 381-387. doi:10.1207/s15328015tlm1604_13

Cochran-Smith, M., & Fries, M. K. (2002). The discourse of reform in teacher education: Extending the dialogue. *Educational Researcher, 31*(6), 26-28. doi:10.3102/0013189X031006026

Darling, L. F. (2001). Portfolio as practice: The narratives of emerging teachers. *Teaching and Teacher Education, 17*(1), 107-121. doi:10.1016/S0742-051X(00)00041-X

Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. *Education Policy Analysis Archives, 8*(1), 23-36.

Dickman, A., Schwabe, A., Schmidt, J., & Henken, R. (2009). *Preparing the future workforce: Science, technology, engineering and math (STEM) policy in K-12 education*. Milwaukee, WI: Public Policy Forum.

Gilman, D. A., & McDermott, M. (1994). Portfolio collections: An alternative to testing. *Contemporary Education, 65*, 73-76.

Hartmann, C., & Calandra, B. (2004). Teacher e-portfolio communities: Diffusion of design knowledge as a catalyst for teacher learning. In R. Ferdig, C. Crawford, R. Carlsen, N. Davis, J. Price, R. Weber, & D. A. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2004* (pp. 110-117). Chesapeake, VA: AACE.

Heritage, M. (2007). Formative assessment: What do teachers need to know and do? *Phi Delta Kappan, 89*(2), 140-145.

Kieffer, R. D., & Morrison, L. (1994). Changing portfolio process: One journey toward authentic assessment. *Language Arts, 71*(6), 411-418.

Moss, G. (2003). Critical self-reflective narrative of portfolio assessment in teacher preparation. *Scholar-Practitioner Quarterly, 2*(1), 45-60.

Moss, G. (2008). Developing a critical lens among preservice teachers while working within mandated performance-based assessment systems. *Teacher Education and Practice, 21*(2), 146-159.

Paulson, F. L., Paulson, P. R., & Meyer, C. (1991). What makes a portfolio a portfolio? *Educational Leadership*, *48*(5), 60-63.

Ring, G. L., & Foti, S. L. (2003). Addressing standards at the program level with electronic portfolios. *TechTrends, 47*(2), 28-32. doi:10.1007/BF02763422

Ring, G, L., & Foti, S. L. (2006). Using eportfolios to facilitate professional development among preservice teachers. In A. Jafari & C. Kaufman (Eds.), *ePortfolio new paradigms in learning assessment and career opportunities* (pp. 127-161). New York, NY: Columbia University Press.

Schön, D. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Smith, K., & Tillema, H. (2003). Clarifying different types of portfolio use. *Assessment & Evaluation in Higher Education, 28*(6), 625-648. doi:10.1080/0260293032000130252

Stone, B. A. (1998). Problems, pitfalls, and benefits of portfolios. *Teacher Education Quarterly, 25*(1), 105-114.

Wade, R. C., & Yarbrough, D. B. (1996). Portfolios: A tool for reflective thinking in teacher education? *Teaching and Teacher Education*, *12*(1), 63-79. doi:10.1016/0742-051X(95)00022-C

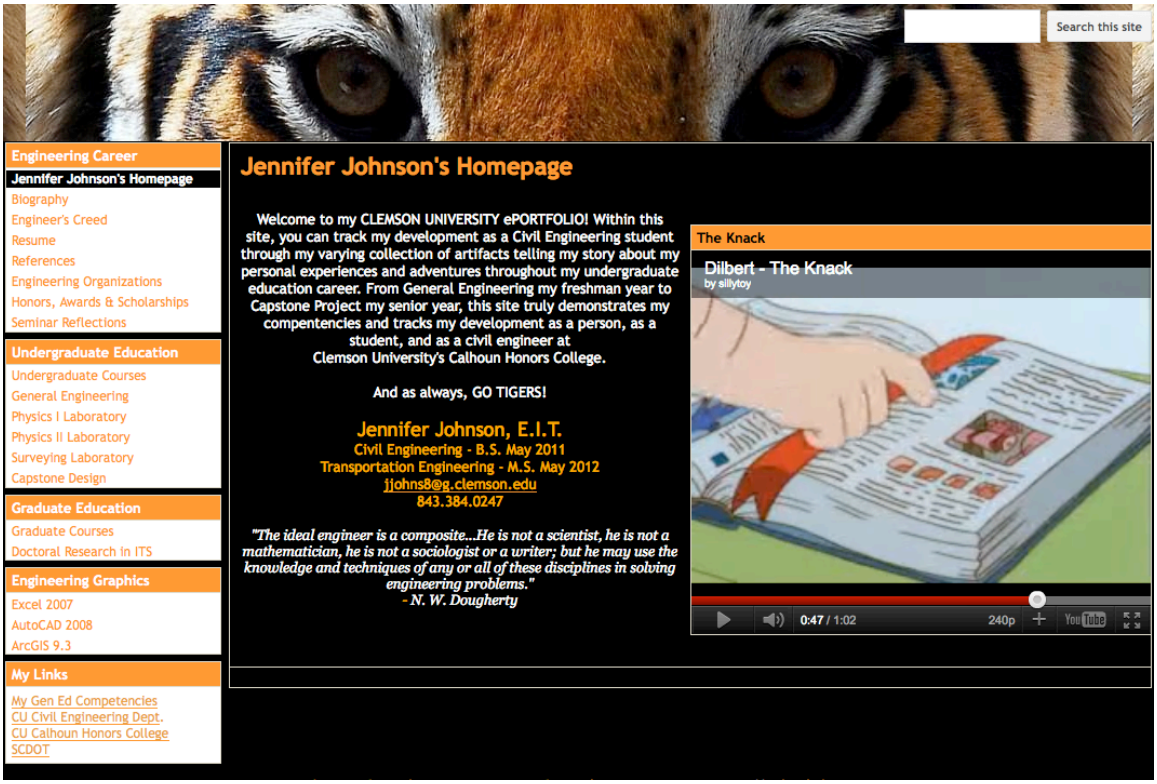
Wiggins, G. (1994). Toward better report cards. *Educational Leadership*, *52*(2), 28-37.

Zeichner, K., & Wray, S. (2001). The teaching portfolio in US teacher education programs: What we know and what we need to know. *Teaching and Teacher Education, 17*(5), 613-621. doi:10.1016/S0742-051X(01)00017-8

GAIL RING is the Director of the ePortfolio Program at Clemson University and an Assistant Professor in the School of Education. Her research is focused on the study of innovation diffusion in an academic setting, specifically as it relates to the use of digital portfolios in a K-20 environment. She has also examined the effects of the integration of a digital learning environment into the middle school science classroom and has partnered with schools in Indiana and Florida on furthering this line of inquiry. She has co-authored book chapters and several manuscripts on innovative teaching, ePortfolios and related topics, and has presented her research at many regional, national and international conferences. Gail has consulted with universities and school districts across the U.S. and abroad on the implementation of electronic portfolios for learning and assessment. She holds a Ph.D. in Curriculum and Instruction from the University of Florida. Her ePortfolio can be found at: http://web.mac.com/gailring/iWeb/RingPortfolio/Welcome.html

BARBARA RAMIREZ directs the multimedia Class of 1941 Studio for Student Communication at Clemson University. She has taught a variety of courses and tutored in the Department of English for 28 years. In addition to teaching courses ranging from Professional Writing for International Students to Children's Literature, Barbara is currently a Ph.D. student in the College of Architecture, Arts, and Humanities' interdisciplinary program in Rhetorics, Communication, and Information Design.

Appendix A
A student's opening page of her ePortfolio created in GoogleSites



Appendix B
View of the competencies and menus in CUePort