

On Implementing Web-Based Electronic Portfolios

A webfolio program lets instructors and students use the Web to improve teaching and learning

By **Paul Gathercoal, Douglas Love, Beverly Bryde, and Gerry McKean**

In 1999, Ray Kurzweil took a look at where technology might be 10 years down the road:

It is now 2009. A \$1,000 personal computer can perform about a trillion calculations per second. Computers are imbedded in clothing and jewelry. Most routine business transactions take place between a human and a virtual personality. Translating telephones are commonly used. Human musicians routinely jam with cybernetic musicians. The neo-Luddite movement is growing.¹

With Kurzweil providing a general sense of the promise of future technology, we focus the discussion on electronic portfolios with our own description:

It is now 2009. A webfolio system used extensively throughout all levels of education supports continuous curriculum improvement, allowing all educators to share teaching and learning strategies, learning resources, and assignments with their colleagues. A Web-based system organizes a student's work and presents it in a student webfo-

lio, displaying not only the artifacts but also the associated assignments and activities. Any authorized webfolio user can assess the student's mastery of curricular standards. A student's webfolio starts in kindergarten, continues through college, and archives a student's lifelong learning and career development. The webfolio also showcases the newest and finest achievements in the student's life work.

While Kurzweil's opening quote might evoke questions about obstacles on the road to realizing his vision, most university and college faculty would expect Web-based student portfolios to be commonplace six or seven years from now. In comparison, our statements about Web-based portfolios sound pedestrian, with any resulting controversy involving why fulfillment of our vision would take so long given the considerable interest in moving from paper to electronic portfolios and the lack of apparent obstacles, especially technical ones.

This was our view when we began implementing Web-based electronic

portfolios at two institutions more than five years ago. After more than 4,000 Web-based student portfolios, our experiences at our own institutions and our work with other institutions indicate that the transition is not as easy as it seems. Successful implementation depends on a set of critical success factors, and in academic settings lacking them, expectations must be scaled back until they are adequately addressed.

We define a webfolio as a tightly integrated collection of Web-based multimedia documents that includes curricular standards, course assignments, student artifacts in response to assignments, and reviewer feedback to the student's work. The integrated collection, and how the collection is stored and used, differentiate the webfolio from other paper and traditional electronic portfolios. The webfolio opens up new possibilities for observing and influencing the interaction among curricula, students, and faculty.

The Enemy Is Us

Remember the Web in 1994, when there was very little content and all of it static? Most university and college

faculty, extrapolating from the tremendous change that has taken place in Web development, would logically expect Web-based student portfolios to become commonplace in a few years. We wonder how this will happen when few instructors will voluntarily put their syllabi and assignments online. The dearth of literature regarding faculty use of electronic portfolios testifies to this paradox.

The irony increases — the literature available on electronic portfolios has more to do with students using the technology than with faculty using electronic portfolios to enhance teaching and learning. Most studies suggest that students are the problem because they do not have the necessary technical skills to make the electronic portfolio work well. MacKinnon found that “[a] survey of the impact of this electronic environment on students’ attitudes reveals that students continue to require significant introduction to the technology in order to overcome the associated anxiety.”² Nonetheless, many studies acknowledge that the hardships encountered in implementing the electronic portfolio are worthwhile for students. Jacobsen and Mueller reported, “The course instructors believe this teaching method, especially the electronic portfolio assignment, contributed to the development of highly marketable educational technology skills among participating students.”³

Most ironically, portfolios are traditionally something done “to” students, rarely something done “with and for” students. Chappell and Schermerhorn look at the history of portfolios this way:

Used traditionally in areas such as fine arts and photography as actual physical portfolios of students’ works, career portfolios have attracted increasing attention in other academic and occupational areas. Regardless of career field, a portfolio is a compendium of materials that document and demonstrate a person’s accomplishments and career readiness. Whether the included materials are samples of an artist’s photographs, a linguist’s

translations, or a management student’s research projects, the objective for the individual is the same — to demonstrate career readiness.⁴

Kist perpetuates this traditional approach to portfolios in the electronic environment:

Students would be allowed time to work on projects of their own in a kind of ongoing multimedia readers’/writers’ workshop. All of this work would be kept in an electronic portfolio over the course of all of the student’s years in school. Over years of schooling, each student’s work would reflect an immersion in reading and writing in many forms.⁵

The literature iterates this traditional view of portfolios over and over. In spite of this, the paradigm has shifted.

Our experiences indicate that a critical success factor for electronic portfolio implementation is a culture where faculty understand their central role in the portfolio process as resource providers, mentors, conveyors of standards, and definers of quality. The major obstacle to successful implementation of Web-based electronic portfolios is not student readiness, it is full faculty participation. We have met the enemy ... and the enemy is us.⁶

The misunderstanding of faculty’s role in the portfolio process stems from a misunderstanding about the portfolio process itself. The problem is magnified when moving from maintaining paper portfolios to exploiting the promise of electronic portfolios on the Web. When using hardcopy portfolios, the media impose limits on the scope of the portfolios. The hardcopy format constrains storage and dissemination, the number of participants in the portfolio process, what each participant can do, and what an institution can accomplish with portfolios. Unless the academic unit has only a few faculty members, the constraints of hardcopy portfolios almost assure that only part of the faculty will participate in the portfolio review process.

When contemplating the move to electronic portfolios, portfolio supporters quickly understand the Web’s promise of rich formats, unconstrained quantity and scope of content, avail-

ability, and potential for integrating curricula. However, these visionaries fail to recognize the associated implications for themselves and other participants. Reaping the full benefits of Web-based portfolios requires more faculty in the academic unit, perhaps all of them, to participate in webfolio processes. Successful implementation requires faculty appreciation of the benefits of tight integration of curricular standards, course assignments, student responses to assignments, and mentor feedback about students’ work — benefits that justify the cost.

Obtaining faculty participation requires demonstrating that their involvement has a payoff for them and potentially a dramatic payoff for the academic unit. Benefits increase for each participant as the number of participants increases.

Obtaining faculty participation is much easier when the academic unit already uses a paper portfolio process. In educational settings where faculty teach courses with little regard for the content relationships with other courses, a significant cultural shift is required to introduce the concept of portfolios and build the critical mass of participation to achieve full benefits from a Web-based portfolio system. A clear definition of the nature of the Web-based portfolio system, of which the student artifacts are just one component, is a prerequisite to this culture shift and a major critical success factor.

From Student Artifacts to a Webfolio System

When portfolios are made electronic, faculty and students tend to collaborate in a “with and for” developmental process:

Electronic portfolios can contain video, dialogues, simulations, links to references, and the interchanges of ideas in a chat room; they can be organized to be accessible in a searchable form; and they are useful in parallel problem solving. Portfolios can be used for student evaluation of personal learning, for program evaluation by showing the development of learners through



their products to a team of evaluators, and for making archives for future generations of learners to build on.⁷

A webfolio enables faculty and students to employ a less adversarial process, as Bartell et al. noted:

Implementation of a Web-based electronic portfolio system throughout the teacher preparation program complements the student-centered approach [California Lutheran University] takes to preparing teachers for the classrooms of tomorrow. The portfolio system is analogous to a relational database that is cooperatively developed by faculty, students, cooperating teachers, supervisors, and employers. It enables a grand conversation among these parties, focusing around the student's professional development.⁸

The next several years will see students routinely make their completed course assignments available on the Web for faculty to access. Implicit in the acceptance of this new situation may be the assumption that the webfolio will be a traditional portfolio, digitized. With this incorrect vision in place, faculty will dis-

miss the webfolio as yet another failed attempt at integrating technology into the "true" culture of education. Without a cultural shift, educators run the risk of joining the neo-Luddite movement Kurzweil predicted.

Disciplines that lack commitment to careful curriculum design will find this shortcoming magnified when attempting to move to a Web-based portfolio system, where curricular content makes up a significant part of the webfolio content. The maximum benefit results when the existing curriculum is an integrated set of courses designed to develop course-specific standards in a fashion that logically produces student mastery of program standards. Curricular prerequisites for use of a webfolio system described here are more likely to be met by educational units already concerned with precise curriculum design.

A Web-Based Portfolio System

The Web-based portfolio system we present integrates support for a variety of "best" educational practices in a single system with significant benefits for all participants: students, faculty, supervisors/mentors, and recruiters.

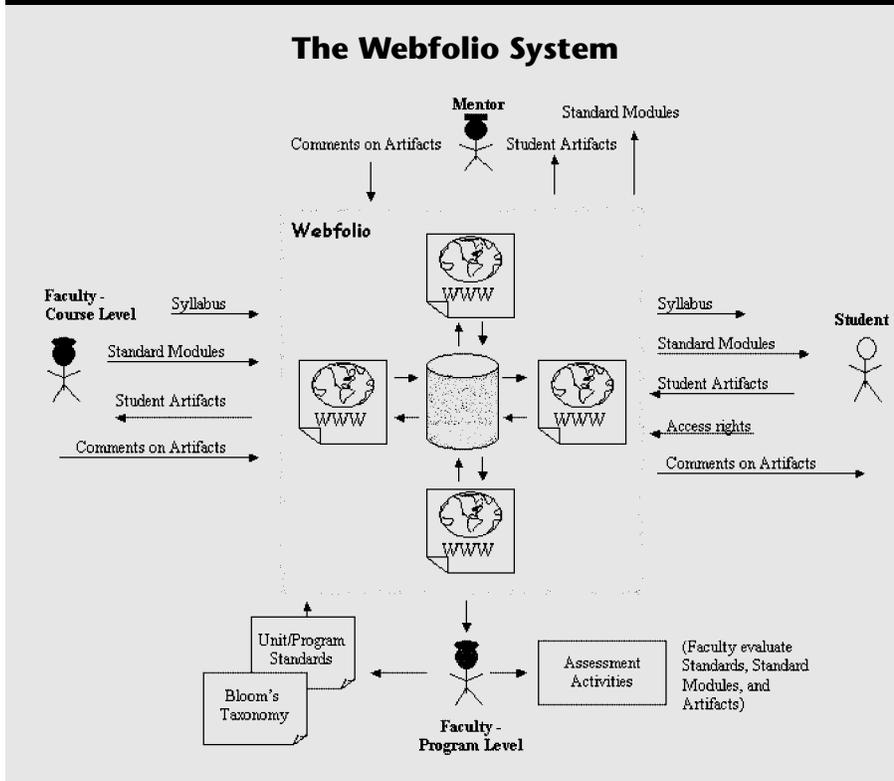
Benefits of Webfolios

The most immediate physical benefit of Web-based portfolios is the elimination of storage problems associated with traditional portfolios. The webfolio lets students house artifacts in a virtual environment. Instructors can simply tap into the webfolio and comment on the artifacts. Students can send an e-mail message with a URL embedded, and anyone in the world can be granted access to their webfolios. Students have complete control over what artifacts are displayed and who can see them. They can have a working portfolio generating artifacts only they can view, a developmental portfolio they share with faculty, and a showcase portfolio they share with the world.

A webfolio system allows for creative thinking and collaboration with others. Students have the resources of the Internet available to them, and they can confer and collaborate with anyone else in the world. Students can present graphics, sound, digital video, text, and other presentation media. The possibilities are virtually limitless.

The webfolio invites self-evaluation and reflection. Students are encouraged to take a heuristic viewpoint and exam-

Figure 1



ine each artifact placed in the portfolio. Faculty can give reflective feedback to the student, and the student can respond by altering the artifact or by ignoring the faculty member's comment. The student could solicit feedback from others before deciding what to do with the piece. The webfolio allows students to construct their own truth, reflecting on each artifact with many mirrors.

Although a professor can have his or her students use the portfolio system for a single course, additional benefits result with substantial faculty involvement. Faculty and students can see the standards and their achievement by students as they progress through the curriculum. Participants have a greater awareness of the content of all courses, not just the ones they are currently taking or teaching, making integration of course content easier. Faculty who develop high-quality standard modules can share them with faculty teaching other sections of the same course. The start-up cost of learning how to use the system is the same whether the student uses the system for a single course or

many courses, but the benefits accumulate with each additional course.

The webfolio irreversibly changes the roles of faculty and student. No longer is the student simply the recipient of information, having become actively involved in constructing meaning by generating and displaying responses to issues raised in a course or program of study. The faculty member no longer simply imparts information, but helps the student construct meaning through facilitation and coordination of the learning environment. Familiarity with the enhanced communications (see Figure 1) embedded in a Web-based portfolio system will help faculty understand the importance of their participation in the webfolio development process.

Webfolios in Practice

Faculty convey standards to students through the webfolio by displaying a syllabus complemented by standard modules (described below) for each course activity or assignment. A student's response to a standard module appears as a multimedia artifact dis-

played in the student's webfolio. That artifact conveys the level of mastery of the standard. After the student allows instructor access to the artifact, the instructor provides feedback in the form of a narrative, including both quantitative and qualitative comments. This feedback is displayed in a comment log that the student can view. Instructor feedback can also be displayed as multimedia comments.

Supervisors and other mentors may view the artifact and add feedback to the log, but only if the student has given them access. The student can revise his or her work, resulting in a modified artifact, then the instructor and other mentors can view each other's feedback and make additional comments on the modified artifact. The process can be iterated until the student, instructor, and mentors are satisfied that the student has mastered the standard. The webfolio processes support both formative and summative assessments of student work at a course and program level.

For each standard module, instructors generate

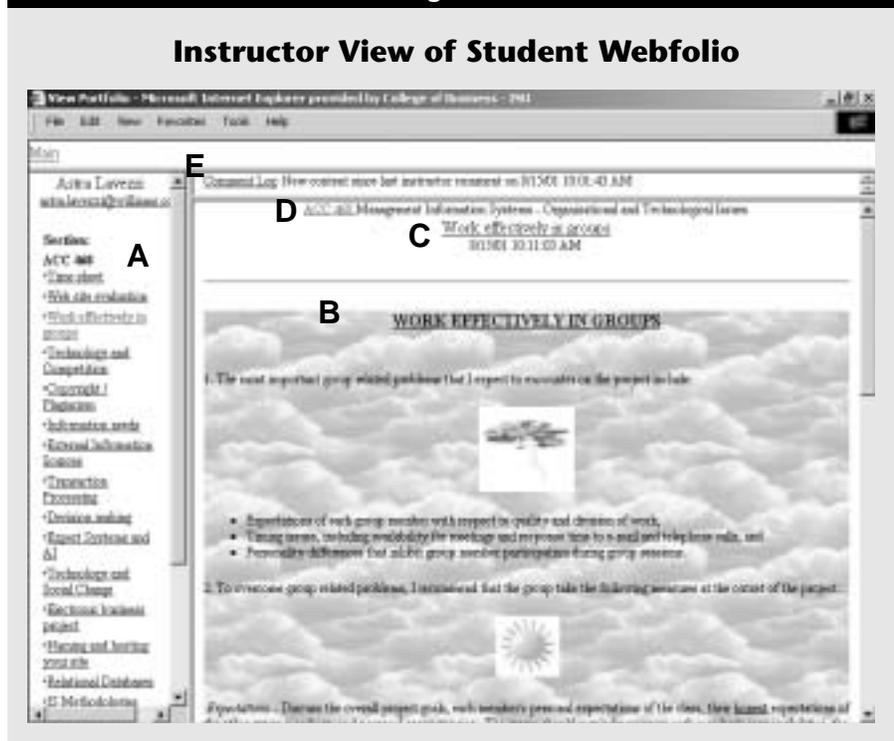
- a statement of the standard,
- a student assignment,
- detail/help/Internet resource links,
- an assessment description, and
- metadata.

The statement of the standard gives the standard a title. Instructors commonly use this title in the syllabus to refer to specific assignments.

The student assignment is a piece of expository text that gives students direction as they continue their study and generate an academic response to the standard. These, too, are generally embedded in the instructor's syllabus or the professional program documentation.

The detail/help/Internet resource links section provides additional detail about the student assignment. It may include relevant lecture materials (PowerPoint presentations, pictures, diagrams, audio and video, notes, and outlines). It can also display links to resources found on the Internet, specific to the standard. This benefit of the webfolio database's organization cannot be overstated. The instructor can update Internet resources at any time, and all students will have

Figure 2



instant access to the updates.

The assessment description section conveys how the student can use the artifact to self-assess mastery of the standard and/or how instructors and mentors will assess the level of student mastery.

The metadata (data about a standard module) represent variables pertinent to a particular professor or academic unit. They are indications from instructors as to how specific standard modules fit within a curricular context. For example, on the instructor level, the instructor nominates how the standard module matches a particular level in Bloom's taxonomy. On the academic unit level, instructors indicate how a particular standard module relates to measures of mastery aligned with a professional program's conceptual framework. Adding metadata to the standard module makes possible hierarchical listings of standard modules based on Bloom's taxonomy. Alternatively, an academic unit can analyze its curriculum to determine if the conceptual framework is incongruent with the curriculum. This curriculum analysis represents a point in time or the curriculum over time because all standard modules are main-

tained in the same database. For academic units responsible to accrediting agencies, this aspect of the standard module development simplifies compilation of curriculum and assessment documentation.

When students enroll in a course, they add the course's syllabus and associated standard modules to their portfolios. Students respond to the standard modules as the course progresses. The standard module is structured such that, when completed by a student, each response results in an artifact that becomes a part of that student's portfolio. The artifact indicates the level of each student's mastery of that standard.

The portfolio system also permits categories of standards not associated with a specific course. Professional programs that require a portfolio containing a summative assessment of student work can include the multiple parts of the defense as a category. A pilot application of the webfolio system at Illinois State University uses a non-course "student life" category to collect activities such as leadership and effective team membership.

Figure 2 shows an instructor's view

of a student's portfolio. A student's view of the portfolio looks similar.

The portfolio system extracts content (labeled A through E in Figure 2) from the database and constructs the page. The left frame (A) contains the contents listing for Astra Levezzi's portfolio. The professor is currently viewing artifact (B), representing her response to the "Work effectively in groups" standard. The student assignment, detail/help/Internet resources, and assessment description parts of the module are obtained by clicking link (C). The syllabus for the course is obtained through link (D). Feedback about the artifact is contained in a log viewed by clicking on link (E). The metadata provided by the course instructor are not available from this view.

Figure 3 shows the listing of contents for a student who has completed several courses, as well as non-course California Lutheran University Education Students (CLUES) benchmark "C" standard modules.

The left frame (A) displays the CLUES benchmark "C" standard modules. The main frame (B) holds the student's response to the module's "Philosophy Statement," which is displayed by clicking on the link of the same name in the left frame (A). As with the previous example, the student assignment, detail/help/Internet resources, and assessment description can be accessed by clicking link (C). Program documentation for "CLUES C" can be viewed by clicking link (D). With the exception of the instructor and mentor feedback logs, anyone with the correct URL and student-granted access rights can view a student's webfolio.

Implementation Strategies and Critical Success Factors

This section will help faculty and academic units determine whether they should attempt to implement a Web-based portfolio system, and whether the implementation should involve an entire academic unit or simply an individual faculty member acting independently. The successful implementation

process used at California Lutheran University's (CLU) School of Education provides an example.

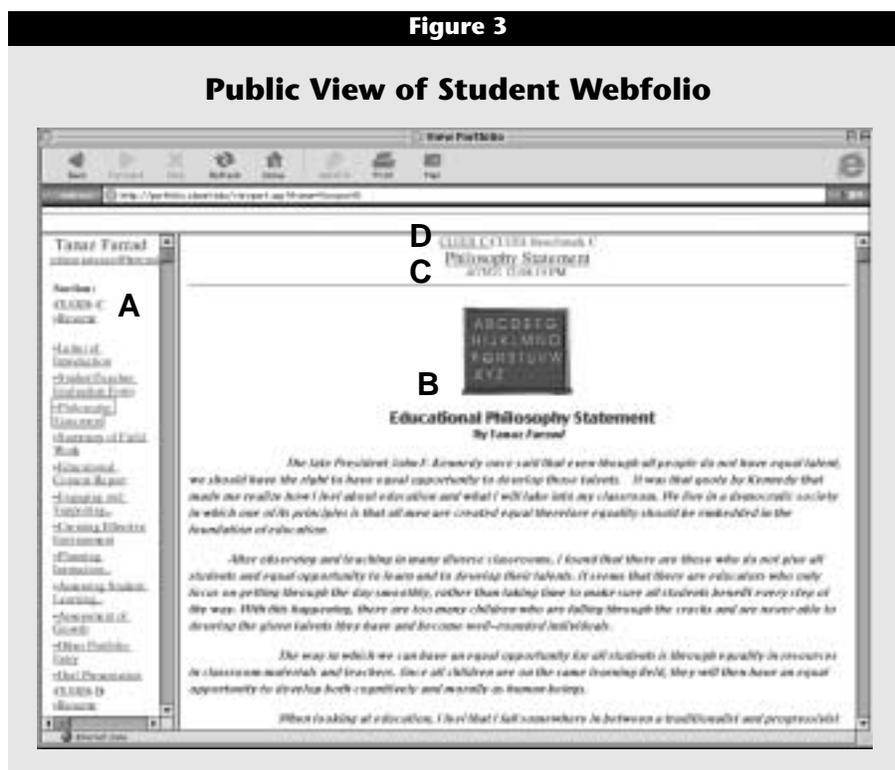
Critical success factors must be present and active in order to implement a webfolio system. Column one in Table 1 lists the factors, though not in order of importance because all are required for success. Column two provides sub-descriptors, and column three indicates factors necessary for single-faculty implementation only. All factors listed are needed for successful academic unit implementation.

Assuming an adequate technology infrastructure (factors 1 and 3), a webfolio system is a logical evolution of the process involving paper portfolios. Providing comments from faculty and other mentors to students is also a logical evolution. However, the process described requires a much greater role for faculty in terms of the number participating in the process and the nature of the participation.

To begin the process, faculty members provide a syllabus, complete with standard modules (factors 9, 10, and 11). Faculty must incorporate the standard modules in their class meetings, examine and assess the artifacts produced by students, and provide students with feedback (factors 5 and 12).

The question remains, how do we get from now, when most faculty choose not to use this kind of technology, to the webfolio system described? The culture of some academic units will hinder the unit-wide implementation of a webfolio system (factor 4), but won't prevent individual faculty from beginning on their own.

Sandholtz, Ringstaff, and Dwyer assert that faculty will not use technology unless they believe it will make a difference in the quality of education provided to their students.⁹ This comes first in implementing the webfolio: convincing faculty that implementation is in the best interests of the students (factor 9). At the same time, there needs to be an "implementing force" that drives faculty to consider this proposition (factor 6).¹⁰ An implementing force can be an idea, a policy, resources, or some other motivating stimulus. Usually,



influencing faculty beliefs will go hand-in-glove with establishing an implementing force, but not always.

At CLU's School of Education the implementing force was a successful "Preparing Tomorrow's Teachers to Use Technology" grant from the U. S. Department of Education. Prior to submitting the grant, the authors took its contents to a Teacher Preparation Program meeting and presented all the goals and objectives for faculty approval or revision. One of the objectives read, "To establish and use throughout the undergraduate and graduate programs an electronic portfolio system that addresses specific competencies in the various disciplines and in the Teacher Preparation Program." This objective passed unchallenged.

Faculty beliefs need to be addressed first and often. Faculty will question the use of technology every step of the way. Those responsible for the implementation must be knowledgeable about the reasons why this technology is good for education and how it works in the best interests of students.

At CLU the initial implementing force and "adaptation" of faculty beliefs was short-lived. Beginning the second year

of the grant initiatives, faculty in the Teacher Preparation Program asked for proof that this technology enhances teaching and learning. The first technology training meeting of faculty addressed this issue, providing information on the benefits of infusing technology into teaching and learning. Faculty accepted the argument and endeavored to implement the webfolio for the second year of the grant. They are prepared to move into the third year of the grant and use the webfolio throughout the program.

Next is to break the implementation down into incremental units with realistic definitions of success (factor 7). Do not try to do everything at once — start small and then expand. Be patient — without an existing "portfolio culture," it may take years.

At CLU webfolio implementation began with two classes of preservice teachers. The first semester, both students and faculty learned about the webfolio, then applied what they had learned the following semester. The next semester involved twice as many students and faculty, and by the end of the second year all full-time students and faculty in the Teacher Preparation

Table 1**Critical Factors for Successful Implementation**

Critical Factor	Subdescriptors and Needed Operators	Needed for Single Faculty Implementation
1. Information Services Cooperation	Information Services can support the Internet traffic to and from the webfolio server.	✓
2. Administrative Support	Administration rewards participants.	
	Faculty participants are not punished for negative feedback on student evaluations of teaching. (A small portion of students will “punish” teachers for new course requirements involving technology.) Dollars are committed to the various requirements indicated in the checklist.	✓
3. Technology Infrastructure	All participants have Internet access.	✓
	All classrooms have Internet access with computer display projection units.	✓
4. Portfolio Culture	Students complete portfolios as a program requirement.	
	Students complete portfolios as requirements in courses. The portfolios carry a significant weight in determining the course grade.	✓
	The student’s work in the portfolio defines the student to faculty and recruiters.	✓
	Multiple faculty/supervisors/mentors read and comment on students’ portfolio work.	
5. Student Learning–Centered Culture	Faculty members routinely give students assignments in written form.	✓
	Students routinely address unstructured problems.	✓
	Faculty grade and provide feedback on students’ work.	✓
6. “Implementing Force” and Project Champions	The push for adoption and implementation of webfolios comes from faculty.	
	A group of faculty members has the commitment and stamina to make the webfolio system work.	
7. Implementation Milestones	An implementation plan exists, with reasonable milestones that are measurable and that collectively lead to full implementation.	
8. Training and Help Resources	Open computer lab assistance is available for students and faculty.	
	Opportunities exist for faculty/mentor training (multiple times and places).	
	Webfolio documentation is available for faculty/mentors and students.	✓
9. Faculty Commitment	Faculty commit to casting course assignments into a uniform format, such as <ul style="list-style-type: none"> ■ Statement of Standard ■ Student Assignment ■ Detail/Help/Internet Resources ■ Assessment Description 	✓
	Teams of faculty agree to cast program standards into a uniform format including an artifact-producing activity demonstrating mastery of program standard modules.	✓
10. Standards- or Competency-Based Curriculum	The academic unit has explicit program standards. Rules may mandate these standards, they may be recommended by professional organizations, or the academic unit may define them independently.	
11. Integrated Curriculum Developed by Teams of Faculty	Faculty teams periodically review and revise the content of the curriculum and are aware of the content of courses making up the entire program. Courses and/or program requirements are designed and sequenced to build student mastery of standards.	
12. Feedback Provided by Supervisors and Mentors Using the Webfolio	Multiple perspectives are represented in the feedback to students. Students value the varied feedback from multiple sources. Students and mentors thrive on ambiguity.	

Program were using the webfolio.

Resource allocation and reallocation is critical to the implementation process, which will need institutional backing and credentials (factor 2). The administration needs to ensure that all involved know that the implementation process is “approved.” Although the project has many champions at CLU, including the dean of education, the chair of the department, and dedicated faculty, it helps to give the process a name. At CLU, the project is called Magnetic Connections, and the newly named process champions are called Director, Clinical Faculty, Curriculum Coordinator, and Open Lab Assistant.

When the implementation process and its people have titles and names, it simplifies explanations. For example, an announcement that the Clinical Faculty will be team-teaching with Teacher Preparation Program faculty raises few questions.

Successful implementation requires regular meetings to provide all faculty with the concepts and skills for successful implementation (factor 8). Meetings should be held during regular teaching hours, and faculty should be compensated for their participation. Webfolio implementation at CLU included having consultants come in twice a year to conduct intensive training in webfolios, plus technology workshops and curriculum revision meetings throughout the year. Faculty participated in an average of 31 hours of professional development meetings, and they were paid for their time and their work on the grant initiatives.

Chappell and Schermerhorn suggested five rules for implementing electronic portfolios:¹¹

Rule 1. Electronic portfolio programs should be mandatory if they are to overcome resistance on the part of many students who remain technically adverse.

Rule 2. Students must not be able to opt out of the program due to deficiencies in their computer skills. These students must be encouraged to recognize their shortcomings and catch up on their own time, with the help of



A well-designed curriculum embedded in a webfolio system enables students' development.

computer lab assistants.

Rule 3. Students need to be challenged and encouraged to select their own materials to include in the ESPs [electronic student portfolios], as long as the required content areas are covered.

Rule 4. The portfolio program must run under defined deadlines, with regular feedback to students. The provision of successful examples early in the process is helpful.

Rule 5. “Portfolio champions” must be involved from the initiation of the program to ensure success and foster imitation.

When implementing the webfolio, CLU found that strictly enforcing these rules was not a good idea. Differing needs for students and faculty, as well as different learning styles and the speed with which different groups accept this new situation, must be considered. For example, some faculty and students left the Teacher Preparation Program because of the webfolio. These were generally less technologically experi-

enced people who thought that they could do their jobs without coming to terms with technology in general.

Conclusion

This article elucidates the critical success factors that must be in place for an entire academic unit or individual faculty member to implement a Web-based electronic portfolio system. Principal to the process is the individual faculty's beliefs about technology and assessment practices. Faculty must vacate the idea that portfolios are something done to students and embrace the notion that the webfolio process is something done with and for students.

A well-designed curriculum embedded in a webfolio system — one that conveys academic standards, contains appropriate resources, and provides vehicles for faculty mentoring — enables students' development and upkeep of developmental, growth, and showcase portfolios at once. A Web-based electronic portfolio system acknowledges and appreciates the intrinsic links between student assessment, faculty, and program evaluation and the meaningful reporting of assessments and evaluations to interested third parties. Campus career planning and student life units may provide their own sets of activities for students to address in their webfolios during their tenure at the institution.

Upon graduation, the student will have a portfolio demonstrating his or her mastery of curricular standards and the interweaving of career planning and student life activities, all displayed as a unique educational experience at the college or university. The most limiting factor surrounding implementation of a Web-based electronic portfolio system will be lack of vision and “creative imagining.” Web-based portfolio systems facilitate assessment, evaluation, and reporting in a single Web portal—a concept we will elaborate upon in another article, on webfolios and assessment. *e*

Endnotes

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