

Electronic Portfolios Need Standards to Thrive

The proliferation of e-portfolio applications requires compatible software and design standards to support lifelong learning

By **Paul Treuer** and **Jill D. Jenson**

More than two years ago, Arthur Levine, author and president of Teachers College, Columbia University, wrote that it won't be long before "every person will have an educational passport."¹ He explained, "Such an educational passport, or portfolio, will record a student's lifetime educational history." Focusing more on learning outcomes than on diplomas that reflect "course seat time," electronic versions of these portfolios seem the likeliest development of Levine's vision.

Trent Batson, director of Information and Instructional Technology Services at the University of Rhode Island, writing in *Syllabus*,² acknowledged that "a general recognition of the usefulness of ePortfolios" already exists and pointed to the resulting momentum the tool is gathering, not just on "dozens if not hundreds of campuses," but also among vendors and publishers. He declared that "electronic portfolios have a greater potential to alter higher education at its very core than any other technology

application we've known thus far."

What, exactly, is an electronic portfolio? Most definitions so far have focused primarily on its purpose. For example, Helen Barrett of the University of Alaska Anchorage, a widely recognized expert on electronic portfolio development, defined it as an organized collection of digital and/or analog artifacts and reflective statements that demonstrate growth over time.³ In *The Chronicle of Higher Education*, Jeffrey Young, senior editor for student issues, described an electronic portfolio as an "extensive résumé that links to an online repository of . . . anything . . . that demonstrates the student's accomplishments and activities."⁴ The American Association for Higher Education (AAHE) also emphasizes purpose, stating that an electronic portfolio—whether produced by a student, a faculty member, or an institution—is for collection, reflection, and assessment.⁵

These definitions seem to assume that the tool's functional aspects are the same

as the current capabilities of any Web-based application. In other words, except for availability on the Web and the ability to use digital technologies, these descriptions portray electronic portfolios, by and large, as merely mimicking their paper counterparts.

A Broader Vision

Envisioning greater possibilities, the electronic portfolio development team for the University of Minnesota (UM) campuses determined at the outset that this tool could do much more than simply imitate its paper equivalent. The UM system's defining feature is that every student, faculty member, and staff member at the institution has lifelong ownership and control of his or her individual electronic portfolio. As the owner, this person can store and selectively share information in that portfolio with anyone, anywhere, at any time. We call this feature "virtual identity."

Not unlike its human counterpart (an individual identity), a virtual identity



undergoes continuous change and is shared with others—though not always under its owner's direction. To a greater or lesser extent, most of us already have bits and pieces of a virtual identity scattered about in the digital domain. Because digitizing and distributing information is so easy, our virtual identities are growing at a phenomenal rate, creating an enormous challenge in terms of access to and control of our own records. As stated in the EDUCAUSE Leadership Strategies series, "The individual can and should be calculated into the formula for distributing and managing his or her personal information. The issues are entitlement and control. Each individual is entitled to easy, full, and direct access to personal records and influence over their distribution and use."⁶

The University of Minnesota defines an electronic portfolio as a tool that can provide this sophisticated control of one's virtual identity. A necessary step in developing virtual identities, however, is using curriculum to guide students in learning to responsibly record and manage personal information, including educational artifacts. Most of us have passively let institutions—hospitals, schools, courthouses, and so on—manage our records. In the digital age, we can no longer afford this luxury. To take control and manage their own information and records, students need support and direction from educators.

Moreover, once students acquire this control over their educational records, it will be equally important that they have an easy way to transport these records to other educational institutions and to the workplace, as well as having recourse to them for individual life experiences outside of work. To make this possible, educational leaders must establish a common set of functional and organizational standards for electronic portfolios. Only through such standards can we design translation software to easily transport electronic portfolio records from one setting to another. Thus, our virtual identities won't be confined to the institution in which we created them but will go wherever life's travels take us, like a passport.

The development and implementation of the UM Electronic Portfolio system over the past six years lets us begin to consider a set of standards for electronic portfolio design across institutions. We can start by describing the features the UM Electronic Portfolio includes.

UM Electronic Portfolio Features

Like other versions of electronic portfolios, the UM Electronic Portfolio is password protected, highly secure, and available online. Its Java 2 Enterprise Edition (J2EE) architecture provides for a robust computing environment capable of accommodating current and pro-

posed portfolio functions. Three integrated features are fundamental to the UM Electronic Portfolio:

- Information is entered not only by the portfolio owner but also by the UM administrative system database.
- Information is stored as granular pieces of digital data (elements) in a highly organized way.
- The portfolio owner selects one or more elements at a time to share online with one or more persons at a time.

These three fundamental features and their applications merit individual discussion.

Entering Information

To enter self-reported information, a UM Electronic Portfolio owner fills out text fields in a template that corresponds to a portfolio element. For example, one self-reported element is the owner's education history. This element contains text fields for the name of the institution(s) attended, dates of attendance, degree(s) earned, and comments (an area to enter reflective text). The owner may choose to attach one or more files and/or Web links to any of the 65 data elements currently available in the UM Electronic Portfolio. In other words, supporting documents (such as a scanned diploma) or Web links (such as the URL for the institution attended) can be attached to this element. Moreover, the system handles

attendance at multiple institutions. Beyond the predefined elements, such as education history, the UM Electronic Portfolio offers customization, so that owners can create new elements to meet specific needs.

In addition to self-reported information, the UM administrative system (in this case, PeopleSoft) automatically displays system information in each owner's portfolio. This includes the owner's name, university ID photo, contact information, demographic information, and education records. An essential aspect of the UM Electronic Portfolio design is that system information is displayed dynamically. This means, first, that an owner cannot modify system-entered information, and, second, the portfolio always displays the most up-to-date information. For instance, the UM administrative system automatically displays each student's registration record in his or her portfolio. An element corresponding to each academic term during which that student was registered displays the course(s) the portfolio owner was registered for at that time. This element also displays grades earned and overall grade point average. Again, because the display is dynamic, the student owner cannot change a grade or a course, but changes made through the university's system automatically update the display.

Storing Information

The UM Electronic Portfolio is highly organized. As in a file cabinet, information is organized into categories (file drawers), subcategories (file folders), and elements (pieces of information in the file folders). Elements are small, highly granular units of information that cannot be broken into smaller units for sharing. Reflecting a broad range of learning and professional activities for the university's undergraduates, graduate students, alumni, faculty, and staff, these elements correspond to activities such as course registration, professional development, and research. Table 1 is a partial list. The organization and selection of elements intentionally supports curriculum-driven learning outcomes, but also goes well beyond enrollment in a set of courses to

include cocurricular activities and personal interests.

Sharing Information

Each UM Electronic Portfolio owner can create up to 100 different folders, each containing one or more self-reported or system-entered elements. The owner can then grant one or more individuals viewing privileges to a folder, which would contain elements specifically selected for that viewer or group of viewers. This sophisticated feature lets owners

easily create a highly individualized, completely secure dossier of material for a specific purpose, such as a job search, and for a specific, self-selected audience of one, several, or many viewers. At the same time, owners can select a completely different set of portfolio materials to put into a different folder for a different purpose and a different audience.

Again, the information shared through the portfolio is dynamic: the selected information appears in a live view. Therefore, if any previously entered

Table 1

Organization of the University of Minnesota Electronic Portfolio

Categories	Subcategories (Partial List)	Elements (Partial List)
Personal Information	Identification Data	Name U-Card Photograph
	Contact Information	E-mail Address Phone: Residence
	Personality Inventory	Myers-Briggs Results
	Documentation	Biographical Statement
Education	Education History	Current Enrollment
	Academic Record	Registration Record Degree Audit
	Assessment Results	ACT Scores
	Learning Styles	Kolb Learning Style Results
	Documentation	Composition Research Paper Course Work Samples
Career	Career Plan	Current Career Plan
	Career Inventory	Strong Interest Inventory Results
	Documentation	Résumé (Educational) Résumé (Professional)
Skills	Computer Skills	Computer Literacy Self-assessment
	Language	Foreign Language Skill: French
	Leadership Skills	Student Body President
Professional Practices	Presentations	Conference Presentation
	Performances	Theater Performance
	Service	Volunteer Project
Recognition	Awards	Academic Honors Earned (Dean's List)
	Certificates	Tutor, Level II

information changes—for example, a course grade or an address—the viewer sees the current, up-to-date information. Thus, even if a piece of information (an element) has been shared with hundreds of viewers via the owner’s portfolio, changing that element once lets all viewers receive the updated information next time they view the folder.

This updateable feature offers great potential for folders like the UM Academic Profile, which contains a predetermined set of elements (also called “default views”). This portfolio folder includes information entered by the university’s administrative system and identified as useful for advisement, so that information is automatically available for viewing by each student’s academic advisor. In other words, the name of each student appearing in an advisor’s advisee list via the portfolio links to that student’s academic profile. The portfolio system’s dynamic nature and its sophisticated integration with the UM system database keep such information current.

Benefits of the UM Electronic Portfolio

Because of its features, the UM Electronic Portfolio can support a wide range of formative (learning) and summative (evaluative) activities. For example, a student can enter one set of materials related to studies in an academic program, another set related to a study abroad program, and a third set related to career counseling. The selection of categories and elements (see Table 1) reflects the scope of potential personal and professional growth. However, because there is no way to identify all the areas of potential growth for each individual portfolio owner, the system allows for expansion and customization. Table 2 illustrates this feature by depicting a portfolio checklist designed for use by majors in the sociology/anthropology department at the University of Minnesota Duluth campus. As students build their portfolios throughout the four years of their undergraduate program, they are encouraged to demonstrate growth through a sequence of learning artifacts, thereby showing formative development in any learning area. The left side of the table displays

input—that is, both system and self-reported elements students might have in their electronic portfolios during their undergraduate studies.

The assessment of learning outcomes, or output, occurs at many levels, because many viewers share the portfolio information and use it in many ways. The right side of Table 2 depicts this flexibility. For instance, a student’s advisor assesses the student’s academic profile to assist with placement and course selection. Instructors in the student’s degree program assess learning achievement. Internship employers assess potential student hires for a good fit between qualifications and job description. Indeed, others, such as a student’s parents, might want to assess progress toward completing a degree (if the student grants parents access to this information). The columns on the right in Table 2 illustrate how the UM Electronic Portfolio design meets the needs of these multiple evaluative processes. Any number of columns could be added. The owner selects different combinations of elements for different folders for various uses, such as advisement, instruction, and job placement. However, this checklist represents only a few of the combinations and types of folders a portfolio owner can create and share after entering a set of high-quality materials.

Most people in the academic community would agree that lifelong learning is an implicit objective of teaching activities. Therefore, the ability to be aware of one’s intellectual development is important, particularly when moving into a career. Accurate and honest self-assessment is a skill educators must strive to impart to developing students. The portfolio’s formative and summative components encourage this development by making the necessary information and learning artifacts readily available to the portfolio owner. Rather than residing at an institution in a paper-based or other type of record-keeping system, the information resides in the owner’s portfolio, providing easy access to all the data needed to support a lifetime of formative and summative evaluation. The portfolio is always a work in progress, with owners managing their personal information for pur-

poses and in ways of their own choosing over time.

So how does this technological tool actually work in an educational institution’s day-to-day operations? We provide two scenarios describing typical use of the UM Electronic Portfolio, one based on a student owner, the other on a faculty owner. Each covers several years to illustrate the system’s application through time.

Student Scenario

First-year college or university students don’t usually grasp the importance of chronicling what they learn so that later they can show they possess skills considered essential by employers or other educational institutions. Because showing growth over time is such a valuable feature of the electronic portfolio, baseline information that students provide as early as their first term is extremely helpful. Therefore, graded course requirements are usually necessary to provide the incentive for students to begin creating a solid electronic portfolio. The ultimate goal, of course, is to make building and revising electronic portfolios a lifelong educational exercise.

As students learn and mature, they realize they will face competition upon graduation, and this usually motivates them to prove they can compete. Although faculty members and advisors should continue to encourage students to refine their electronic portfolios, success-oriented students will begin taking the initiative, with or without course requirements. They will begin to decide on additions, deletions, and modifications (in this case, the element will display the date it was last updated). They will also decide who will have access to particular elements of their portfolios and for how long, when to update what each viewer can access, and when to deny access altogether.

Regardless of whether students recognize the importance of lifelong learning, UM system graduates have lifelong access to their portfolios. In granting this access, the university necessarily committed to maintaining and upgrading its technology to ensure that not only its students but also its faculty and staff can take advantage of this opportunity. Although

Table 2

Portfolio Checklist for B.A. in Sociology/Anthropology at the University of Minnesota Duluth

Input (Enter)				Portfolio Organization (partial list)	Output (Share)		
Freshman	Sophomore	Junior	Senior	Categories Subcategories Elements	Advisor	Degree Program	Internship
				Personal Information			
				<i>Identification Data</i>			
Adm	Adm	Adm	Adm	Name of Record	Adm	Req	Req
Comp				Additional Name: Preferred Name		Req	Req
Adm	Adm	Adm	Adm	U-Card photo	Adm	Sug	
Adm	Adm	Adm	Adm	Identification Number of Record	Adm	Req	
				<i>Contact Information</i>			
Adm	Adm	Adm	Adm	E-mail Address of Record	Adm	Req	Req
Adm	Adm	Adm	Adm	Phone Number	Adm	Req	Req
				<i>Personality Inventory</i>			
C Ser	C Ser	C Ser	C Ser	Myers-Briggs Results		Sug	
				Education			
				<i>Academic Record</i>			
Adm	Adm	Adm	Adm	College and Major	Adm	Sug	Sug
Adm	Adm	Adm	Adm	Registration Record (courses/grades)	Adm		
Adm	Adm	Adm	Adm	Degree Audit	Adm		
				<i>Education Documentation</i>			
Comp				Research Paper (rough draft and final)			
				Career			
				<i>Career Plan</i>			
C Ser	C Ser	C Ser Req	C Ser	Career Plan: Sociology		Req	Sug
C Ser	C Ser	C Ser Req	C Ser	<i>Career Interest Inventories</i>			
				Strong Interest Inventory Results		Req	
				<i>Career Documentation</i>			
C Ser	C Ser	Req Req Req	Req Req Req	Résumé		Req	Req
				Sociology Internship Objectives		Req	Sug
				Sociology Internship Application		Req	Req
				Skills			
C Ser	C Ser	C Ser	C Ser	Computer Skills		Req	C Ser
				Professional Practices			
				<i>Professional Membership</i>			
C Ser	C Ser	C Ser	C Ser	<i>Professional Practices Documentation</i>		Req	C Ser
			Req	Theory/Best Practices Paper		Req	Sug
				Recognition			
C Ser	C Ser	C Ser	C Ser	<i>Academic Honors</i>		C Ser	C Ser

Adm: UM administrative system information

Sug: Suggested by sociology/anthropology department

Req: Required by sociology/anthropology department

C Ser: Recommended by Career Services

Comp: Composition course requirement

a decade of learning is not particularly long in terms of a lifetime, the following scenario describes potential portfolio use over a 10-year period by a fictitious student we'll call Amanda Wilson.

First-Year Student, Fall Semester, 2003

As part of Amanda's required freshman composition course, she learns what the electronic portfolio is and what it

can do. She sees that the university has automatically entered information about her: the photograph taken for her ID card; the courses she's registered for; her address, phone number, and student ID number; and so on. However, she understands that except for her advisor, whose role grants him access to her educational information, no one else can access this information without her consent. As part of her required composition course,

Amanda learns to upload a draft of her research project as well as the final paper, something she has worked on the entire semester. She is encouraged to choose a product from each of her other classes to include in her electronic portfolio as well. For fun, she uploads her high school graduation photo and creates a link to her personal Web site. She decides to supplement the system-provided information by sharing her final research

paper with her advisor because she wrote on a topic related to her major, elementary art education. She shares photos and her public Web-site URL with three new friends who live in the same on-campus apartment building.

Third-Year Student, Spring Semester, 2006

Amanda has changed her major to graphic design and is seeking an off-campus internship for her senior year. She is particularly interested in two local businesses, each with a different focus. To appeal to both, she creates separate résumés and cover letters, matching her skills to the particular needs of each. She also requests letters of recommendation from various people able to attest to her suitability for each job.

For the first employer, Amanda wants to emphasize her photography experience. She creates two photo galleries, one showing work from her second semester in school and the other showing work recently completed, during her fifth semester. Even she is surprised at how much her skills have advanced in that time, so she decides to write a brief commentary documenting her development.

For the second employer, Amanda needs to emphasize design skills. She makes links to Web sites she has created, uploads animated files, and graphically logs the process she went through to create a logo for a course assignment.

Finally, Amanda compiles separate folders to share electronically with each employer, carefully selecting material relevant to each from the many elements available in her portfolio. She grants both employers access to the photo galleries as well as the design pieces. Both employers also receive access to various writing samples, drawings, and video clips of Amanda making class presentations. However, for the accompanying career-related materials, Amanda selects for each employer only those pieces—résumé, cover letter, and letters of recommendation—that best demonstrate the skills most pertinent to that business.

Alumna, 2011

Since her graduation in the fall of 2007, Amanda has worked full-time at

the business in which she interned during her last year at the university. However, she knows that she has advanced as far as she can in this position and wants to try something more challenging, maybe even graduate school. Throughout her career, she has continued to electronically file especially good work in her electronic portfolio. This makes applying for new jobs or to graduate programs quite easy. She updates her résumé and cover letter, again to suit various employers. She writes a personal statement appropriate for an admissions committee.

Because her portfolio now includes many pieces produced during her employment, Amanda carefully selects samples to include for each potential viewer. Nevertheless, she finds that she still must rely on some work she created during her undergraduate education, types of work she hasn't had the opportunity to do since. Even after all these years, the work she chooses to share, as well as the samples she continues to archive, is only a mouse click away. Her complete university transcript is also available; she doesn't have to write a letter or visit an office. Because all her letters of recommendation have also been filed in her portfolio, she need only choose which writers to contact for updated letters and which letters to send to each company or school. Certificates, awards, and various other types of recognition Amanda received over the years have been scanned into her portfolio to provide evidence of her high-quality work. Clearly, the opportunities available to her and the ease with which she can take advantage of them by using her electronic portfolio were unimaginable just a few years ago.

Faculty Member Scenario

Faculty members know that students won't spend time on something that doesn't benefit them in some way. Because the electronic portfolio is a new learning tool, faculty members must help students understand the advantages of using it. Although students have learned to let administrative offices manage information about them, faculty can help digital-age learners take control of their own

information. Students unprepared to do so are unprepared for their future, regardless of their career or educational plans.

The UM Electronic Portfolio's sophistication lets faculty help students acquire skills to be lifelong learners. Some faculty balk at the time they imagine such assignments might require, but experience shows that students are technologically savvy. Once they understand the tool's capabilities, the importance of using it, and the advantages it offers for their future, students find a one-hour class session sufficient for learning how to use an electronic portfolio. Then students are equipped to independently update and refine the elements in their portfolios and the views they offer to others.

Moreover, the UM Electronic Portfolio offers faculty capabilities for professional and personal use that other Web-based systems lack. As the AAHE points out in its book,⁷ review and tenure committees typically use faculty portfolios for assessment during promotion and tenure consideration. Portfolios also serve for reflection and for improving course materials by facilitating sharing among colleagues. Electronic portfolios conforming to standards such as those built into the UM Electronic Portfolio will let faculty share portfolio contents across institutions with greatly enhanced flexibility. Note that UM Electronic Portfolio owners respect copyright policies for any materials to which they pertain. In addition, the high degree of selectivity and security the system offers guards against universal access to any material contained in a UM Electronic Portfolio, thereby ensuring privacy.

With these features in mind, let's see how one of Amanda Wilson's teachers, (the fictitious) Montgomery Smith, could use the UM Electronic Portfolio to do far more than simply assign various lower- and upper-division course projects.

Assistant Professor, Spring Semester, 2005

Assistant Professor Montgomery Smith has been contacted by Amanda Wilson, a second-year advisee, who doesn't know why there's a hold on her records that prevents her from registering for spring semester classes. Smith opens his

electronic portfolio to the advisement view, quickly finds Amanda's records, and discovers the reason for the hold: an unpaid library fine. This discovery required no calls or visits to the registrar's office or the library. He e-mails the information to Amanda and reminds her that before she registers, she should update her educational plan, include it in a portfolio folder, and share it with him. He also lets Amanda know that her parents recently contacted him, asking about her grades from last semester. He reminded them of the Family Education Rights Privacy Act (FERPA) regulations, which prevent him from providing such information, but he encourages her to create a portfolio folder that includes her course grades from the last two semesters to share with her parents. Perhaps she could include some course assignment samples as well. Because her grades had improved considerably, he was certain Amanda's parents would be satisfied with her progress.

Faculty Member Seeking Tenure, Spring Semester, 2008

After serving as a faculty member for six years, Assistant Professor Smith is preparing his materials for the tenure process. Since his first year on campus, he has been archiving evidence of his academic achievements in his electronic portfolio. He has included

- each published article (as well as links to those available on the publishing journals' professional sites),
- links to his course Web sites,
- reviews of a book he completed the previous summer,
- PowerPoint presentations he made at national and regional conferences,
- copies of student and peer evaluations,
- reports he completed for several committees on which he served,
- certificates of recognition for teaching excellence,
- copies of each of his probationary reviews, and
- letters from internal as well as external reviewers.

Smith's reviewers, whether on or off campus, had been granted portfolio access to the materials they needed to write their reviews. Because his portfolio

contained all of the materials, selecting the appropriate materials and creating a folder for each person involved in the process, including the tenure committee members, took very little time.

Tenured Faculty Member, Fall Semester, 2009

Associate Professor Smith's spouse has been offered a job in another state. Having decided to leave Minnesota, he must seek a position at another university. Fortunately, the area to which they are moving provides many teaching opportunities in higher education, ranging from a university to a small private college to a two-year community college. Smith realizes that each institution's mission is different, so he uses his portfolio to create for each search committee sets of materials that vary considerably in emphasis. For the university search committee, he emphasizes his research agenda, providing links to each of his many publications. For the private college, he emphasizes his advisement and service accomplishments. For the two-year college, he relies heavily on his excellent teaching record. He grants search committee members at each institution guest access to the portfolio folder that matches the position they seek to fill. When he is offered and later accepts a position at one of the schools, he revokes access to materials previously granted to the other two institutions.

On-Leave Faculty Member, Spring Semester, 2011

Professor Smith has been granted a single-semester leave at the institution he now serves. He is in London conducting primary research for his latest project. Checking his e-mail, he finds a message from a former advisee, Amanda Wilson. She has kept in touch since graduation, occasionally sending work samples as she progressed professionally. He is happy to hear that she is seeking a new challenge and agrees to write an updated letter of recommendation that will attest to her academic discipline as well as her career-related abilities. He reviews the portfolio folder she has updated and shared with him. It reminds him of the excellent grades

she received, the thoughtfully prepared and executed educational plan she followed, and the vast improvements in her professional skills. He is pleased to recommend her for graduate school.

Proposed Standards for Electronic Portfolios

For educators to build electronic portfolios useful to each learner regardless of age, area of residence, or institutional affiliation, they will have to create a common set of standards for electronic portfolio design. This is the only way portfolios can truly become an educational passport useful in any type of educational setting, as well as for professional development in any career path. Institutions will have to cooperate and collaborate to realize the full potential of electronic portfolios. As with any major educational shift in thinking, this effort necessarily involves setting standards.

Development and implementation of the UM Electronic Portfolio system over the past six years permits us to consider a set of standards for electronic portfolio design across institutions. Standards must be sufficiently flexible to include self-study as well as the highly structured educational programs offered at most institutions. Here we begin to identify the functional areas that can benefit from a set of common standards. These standards are based on the premise that the electronic portfolio is designed primarily to let individual owners manage a wide range of educational, personal, and professional records. Portfolios can already serve effectively for accreditation and other institutional purposes. However, the criteria for standards that become common across institutions must be based on how useful they are for individual owners in multiple settings over time.

The electronic portfolio's primary functional areas must be capable of the broadest possible learning and assessment activities. With that goal in mind, we've organized the suggested standards into the major functional areas—entering, storing, and sharing—with each area able to support a rich array of artifacts demonstrating learning. Although not exhaustive, the list begins to iden-

tify overarching standards that developers must strive to meet as more and more features are incorporated into electronic portfolio software.

Standards for Entering Information

- Information can be self-reported as text, uploaded files, and Web links.
- Administrative information from multiple institutions and organizations can be dynamically displayed in an individual's electronic portfolio.
- Standardized assessment results included in a portfolio assist students with educational, career, and other types of placement.
- An electronic portfolio developed at one educational institution can be transferred, in its entirety, to another institution.
- Entered information is integrated automatically into calendar, e-mail, and other online management systems.
- Checklists of required and/or recommended elements specific to individual, curricular, cocurricular, and institutional or career standards guide portfolio owners to enter information over time.
- Portfolio users, including educators, students, employees, counselors, and others, can create checklists to reflect standards or customized rubrics.
- Entered work samples can be associated with one or more professional standards.
- Portfolio owners can create multiple new elements.

Standards for Storing Information

- Information is stored in granular units (elements).
- Storage is based on an established, organized structure composed of categories, subcategories, and elements.
- The organized structure has sufficient breadth to accommodate learners ranging widely in age, occupation, and abilities.
- Text fields and prompts encourage reflection.
- Information and files are backed up regularly.
- Portfolio accounts are available for life.

- Stored information is portable to other electronic portfolio systems.
- Stored information is highly secure.
- Federal regulations, such as FERPA, protect stored information, and institutional policy protects the privacy of student, faculty, and staff records.

Standards for Sharing Information

- The electronic portfolio owner controls viewing privileges to information contained in the portfolio.
- The electronic portfolio owner can track viewing privileges and the extent to which the information has been viewed.
- Information is shared dynamically such that the electronic portfolio owner is sharing live, changeable information.
- Multiple folders are customizable and can be shared with one or more individuals or groups and the public.
- Multiple default views (folder templates designed for specific purposes and which may or may not be institution specific) are available and can be shared with one or more individuals or groups and the public.
- Shared folders can be sorted and organized into standardized reports.
- The owner can customize the organization, layout, and appearance of shared views.
- Portfolios include options for user feedback relating to shared material(s).
- Options to save a folder to a file and/or a compact disk are available.

Aiming High

These proposed standards for electronic portfolio systems used in educational institutions are based on our experience at University of Minnesota campuses. We offer them not as a definitive list but rather as a starting point for discussion and, as systems are developed and used, for evaluation.

Building electronic portfolios that abide by common standards offers many advantages. Like travel passports, electronic portfolios will be portable to any learning environment, formal and otherwise. Furthermore, electronic portfolios will integrate easily into multiple

course management systems, providing an especially significant benefit to educators as they teach students to identify and document learning outcomes.

Today's technological capabilities already extend far beyond Web-based versions of electronic portfolios. Therefore, educators should provide the means and the opportunity for students to manage information about themselves, rather than leaving it to scattered and incompatible educational institutions and systems. Such a course of action is truly revolutionary because it fosters a shift from passive to active management of each individual's ever-growing digital record, thereby empowering learners engaged in any type of learning activity to identify, reflect upon, and record multiple learning outcomes. Furthermore, it is revolutionary because it lets the portfolio owner decide which pieces of a rapidly growing digital identity to share and with whom.

The challenge of making these standards available across multiple institutions is daunting. Electronic portfolio software developed by multiple vendors will not be uniform. As a result, students will develop portfolios using different types of software at different stages of their educational and professional careers. Without standards, such a process will become unworkable as the amount of digital information increases.

We recommend that sponsoring organizations such as EDUCAUSE, the Open Knowledge Initiative (OKI), and the IMS Global Learning Consortium host initiatives to assess electronic portfolio software, encourage the adoption of standards, and assist software developers in the construction of compatible systems. One such initiative is the Electronic Portfolio Action Committee (EPAC) Virtual Community of Practice,⁸ originated through the National Learning Infrastructure Initiative (NLII) to "engage in the creation, use, publication, and evaluation of electronic portfolio projects and tools in higher education and beyond for teaching, learning, and assessment." We hope that groups such as EPAC will advocate strongly for the development and use of uniform electronic portfolio standards.

Open Source Portfolio Initiative

By Jack Brown

The University of Minnesota has donated its Electronic Portfolio code base to the Open Source Portfolio Initiative (OSPI). OSPI is a collaborative effort to create a more robust electronic portfolio application through the combined efforts of the open source community. OSPI provides users the electronic portfolio code, free of charge, through an open source license agreement. Users are encouraged to share their improvements with others in the community, in hopes of creating a better electronic portfolio application.

Initial OSPI partners, in addition to the University of Minnesota, include the University of Delaware and The RSmart Group of Phoenix, Arizona. Established in January 2003, OSPI was set up to work collaboratively toward the creation of electronic portfolio solutions with common function, naming, and

technical standards available in robust computing environments free of ties to proprietary software. Announcements about OSPI, including demonstrations and details about obtaining the code, are available at the OSPI Web site, <<http://www.the.OSPI.org/>>.

Technical Architecture of OSPI's Electronic Portfolio

OSPI's electronic portfolio application has been coded to the JSEE 1.3 standards for Web applications and thus can run in any compliant Web container, including JavaServer Pages Standard Tag Library (JSTL). A Jakarta-struts framework is being used to standardize the model-view-controller framework and to implement internationalization and customization needs easily.

The application can connect to existing student administration systems,

such as PeopleSoft, to display student information. Existing authentication processes, such as Lightweight Directory Access Protocol (LDAP) and x.500, can be used to authenticate users according to each institution's guidelines. OSPI's electronic portfolio can link multiple data sources into a single electronic portfolio. In the future, the goal is to link data sources from different institutions to one electronic portfolio.

The project uses open source project management tools, such as the Concurrent Versions System (CVS) code repository for version control and Bugzilla for bug tracking. The reference implementation uses open source server components, such as the Linux operating system, Apache Web server, Jakarta-tomcat servlet container, and Jakarta-commons Database Connection Pooling.

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Recognizing the near limitless potential of electronic portfolios, understanding that additional development bears a price, and realizing the high demand for such an application at other educational institutions, the University of Minnesota recently decided to place its portfolio application in the open source market (see the sidebar "Open Source Portfolio Initiative"). In so doing, the university hopes that other portfolio developers will do the same, thereby ensuring that as such tools develop, new features will adhere to an evolving body of standards that will guide all such efforts.

Conclusion

Efforts to develop electronic portfolio software are increasing rapidly. The use of common standards will enhance the value of this new and exciting tool. We believe the functional standards we have identified should be incorporated into all electronic portfolio software. Ultimately, students should take ownership of their

educational records and use them like a passport to travel freely from one learning environment to another. Establishing common functional standards for electronic portfolios will move us closer to this goal. *e*

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Endnotes

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