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# Adopting an Electronic Portfolio System:

# Key Considerations for Decision Makers

Rebecca L. Fiedler

University of Central Florida

Dorothy Pick

University of Central Florida

## Executive Summary

The use of electronic portfolios for authentic student assessment is growing rapidly (Batson, 2002). Creating portfolios electronically offers a number of benefits not available using traditional paper-based portfolios. Advantages include the portability from one application or institution to another, wider accessibility of the portfolio, and the reusability of artifacts in different contexts and to create multiple portfolios.

The two broad approaches to eportfolio implementation have advantages and disadvantages. Some experts advocate using generic tools (e.g., word processors, HTML editors, portable document format) to create eportfolios. Advantages to this approach include flexibility for portfolio authors to customize their portfolio to reflect their individuality and portability from one system to another. Start-up cost may also be low using this approach. However, generic tools carry disadvantages. Authors unskilled with the tools may suffer cognitive overload, producing lower quality portfolio content as they struggle to use the tools. Second, it is hard to aggregate data from portfolios created using generic tools. Finally, securing the contents of the electronic portfolios may be difficult if they are to be accessible from Internet-connected computers.

Alternatives to the traditional generic tools are specialized electronic portfolio systems. These take advantage of computer databases, servers, interfaces, and custom programming. Advantages of such systems include more powerful data aggregation to satisfy accountability mandates, simplified security procedures, increased opportunities to create multiple portfolios for diverse purposes, computer-mediated communication between portfolio authors and their advisers, and a less steep learning curve for the portfolio author. However, disadvantages are evident. The portfolio author's ability for self-expression is limited. Some customized systems

are expensive to implement and maintain. Proprietary structures and file formats may limit portfolio portability.

Many customized eportfolio systems can be integrated with existing student information systems and course management systems. An advantage of tightly integrated systems is the ability to repurpose existing information and artifacts for use in portfolios. However, tightly coupled systems such as these require security to prevent unauthorized access to private personal data.

Selecting an eportfolio system requires rigorous attention to pedagogical and technological considerations. Pedagogical considerations include the level of users' technical skills, user access to technology, staff development needs, curricular standards to be met, the level of creativity desired, access to student reflections, and data aggregation needs. Additional pedagogical concerns are illustrated in the top half of Figure 1.

Technological considerations are equally complex, including budgets for hardware, software, and technical support, the capacity of the institution’s infrastructure, system scalability, usability issues including plug-ins and utilities, authentication systems, required technical standards (e.g., ODBC- and SCORM compliance) and ongoing system maintenance. Additional technological concerns are illustrated in the bottom half of Figure 1.

As technological and pedagogical considerations are addressed, a set of requirements will emerge. The requirements and preference decisions, along with the results of usability testing, should guide selection of an electronic portfolio system. This paper addresses many of these decisions in detail, describes selected electronic portfolio systems, and identifies additional eportfolio resources.

# Electronic Portfolios: An Overview

For many years, artists have used portfolios to showcase their work, demonstrate their skills, and find employment. Portfolios are now being used in a variety of fields, including, but not limited to the humanities (Reiss, 2001), information literacy (Fourie & van Niekerk, 1999, 2001), management (Zalatan, 2001), and nursing (Lettus, Moessner, & Dooley, 2001). Portfolio assessment is also gaining popularity in K-12 and higher education as both teachers and students collect artifacts to demonstrate skills in specific areas (e.g., Shulman, 1998; Carpenter, Ray, & Bloom, 1995; Karoly, 1996; Lyons, 1998; Snyder, Lippincott, & Bower, 1998; Quinlan, 2002). Several definitions of portfolios have been offered. One of the most frequently cited is that of Paulson, Paulson, and Meyer (1991): "A portfolio is a purposeful collection of student work that exhibits the student's efforts, progress, and achievements in one or more areas. The collection must include student participation in selecting contents… and evidence of student self-reflection" (p. 60). Similarly, Shulman (1998) of Stanford University defines a teaching portfolio as "the structured, documentary history of a set of coached or mentored acts of teaching, substantiated by samples of student portfolios, and fully realized only through reflective writing, deliberation, and conversation" (p. 37). Barrett (2001b) believes "an electronic portfolio is really a living history of lifelong learning."

This paper discusses a cross-section of issues related to portfolios, eportfolios, and eportfolio development and implementation. Topics include a look at the dilemmas faced by implementers, technological and pedagogical concerns raised in the literature, information about the portfolio development process, clarification of important terms, criteria for evaluating eportfolio tools, and an examination of various eportfolio tools. Important concerns, both technological and pedagogical are addressed and a structure for thinking about those issues is

proposed. Finally, the paper closes with a list of useful resources and organizations for the decision-maker interested in locating additional information about electronic portfolios.

## *Defining Electronic Portfolios*

As technology becomes increasingly available, student portfolios are moving from paper formats to electronic formats. Experts distinguish between various electronic portfolios and electronic portfolio implementations in subtly different ways. Barrett (2000) defines electronic portfolios to include "the use of electronic technologies that allow the developer to collect and organize artifacts in many formats (audio, video, graphics, and text)" (p. 15). Barrett emphasizes that "an electronic portfolio is not a haphazard collection of artifacts (i.e., a digital scrapbook or multimedia presentation) but rather a reflective tool that demonstrates growth over time" (p. 15). Barrett (2003) distinguishes between electronic portfolios and online assessment management systems. Many teacher education systems are implementing electronic portfolios to meet NCATE standards. These systems often resemble an online assessment management system, complete with numerical scoring, rubrics, and statistical analyses. Trent Batson (2002) uses the term eportfolio to refer to "database-driven, dynamic web sites, not static, HTML-driven sites" (p. 2). The online assessment management systems are typically database-driven. These distinctions can result in vastly different implementations.

The use of eportfolios is growing in popularity. Electronic portfolios are used for such diverse purposes as assessment, accreditation, reflection, and professional development. An increasing number of eportfolio developers are entering the market, facilitating the portability of file types including text, graphics, video, audio, photos, and animations. This increasing popularity is due, at least in part, to the increasing use of digital formats for student work and the need to organize, search, document, and transport this work. These activities take advantage of

computer capabilities of storage, display, retrieval, and communication to change curricula (Batson, 2002).

The American Association for Higher Education (2003) has proposed a "Taxonomy for Electronic Portfolios" to facilitate discussions about the various kinds of eportfolio implementations. This taxonomy has three main discriminators: context, author, and purpose. Understanding these dimensions for your specific need is important to select the "right" portfolio system or tool. The context describes the setting in which the portfolio was developed. Contexts include courses, programs, institution, inter-institutional, and independent portfolios. For example, depending on the context, data aggregation may or may not be an important factor to consider. The author of an electronic portfolio may be a student, faculty member, administrator, organization, or other individual including those not specifically affiliated with the learning organization. Knowing the portfolio authors, and their skills, should influence your decision. Purposes for portfolios include development (self-assessment, advising, documenting learning over time, documenting professional development, building the curriculum, adding to the knowledge base of or among the disciplines), evaluation (achievement of learning outcomes, high stakes evaluation, accreditation, promotion and tenure), and presentation (showcasing achievement, publicizing organizational reflection and progress, and responsiveness to state and national need for information). The variety of purposes will determine the level of creativity and flexibility required of the selected system.

### *Dilemmas Eportfolio Authors Encounter*

Electronic portfolios can be developed using one of two broad approaches: using generic tools (word processors, HTML editors, portable document format, authoring software) or using customized information systems including databases, servers, interfaces, and custom

programming (Gibson & Barrett, 2002). Each approach has both advantages and disadvantages, forcing eportfolio authors to make choices that are oftentimes difficult.

Joanne Carney (2002) completed case study research that examined the decision-making of electronic portfolio authors. Her findings help illuminate the decision about which type of electronic portfolio tool to implement. She identified six dilemmas that must be confronted by those interested in electronic portfolio implementation. Those dilemmas are:

1. Multiple-purpose dilemma – Students are encouraged to create portfolios for multiple purposes and multiple audiences. Too often, these purposes are in conflict with each other and the result is that none of the purposes are served well. An example of this type of conflict can be found in pre-service teacher education. Pre-service teachers are asked to include reflections on their teaching internship in their portfolio. They are encouraged to reflect on their mistakes and share what they learned from that mistake. However, teacher educators also suggest the portfolio be used for credentialing purposes. Students may be understandably reluctant to share the same information about their mistakes with a licensing agency that they share with a trusted professor. This conception of the portfolio also being used in a high-stakes assessment situation often motivates the portfolio author to downplay any problems they had in teaching despite the learning benefit from a critical examination of such a problem. Portfolio authors are likely to experience a constant tension between the conflicting purposes of their portfolio.[SCC1]

2. Personal-revelation dilemma – Electronic portfolios are frequently placed on the Internet for a worldwide audience. Revealing personal difficulties is a source of discomfort for many people and can be used against them in countless ways.

3. Cognitive-overload dilemma – This dilemma is exacerbated by the use of generic tools. Portfolio authors lacking the technological skills to produce an electronic portfolio spend

cognitive capital coping with their technological deficiencies at the expense of portfolio content. Even portfolio authors with a high degree of skill spend capital planning and executing specific tasks and exploring new capabilities. With customized systems, the cognitive overhead is less than that required to use generic tools.

4. Self-expression dilemma – Electronic portfolio authors using customized systems are often constrained by the systems they use. These authors exert less control over format, appearance, and structure than a portfolio author skilled in using generic tools. Portfolios are often considered a very personal reflection of self, and this constraint can be a source of dissatisfaction. On the other hand, the unskilled users of this system can readily select an aesthetically-pleasing, but pre-determined template to create an eportfolio.

5. Dead-end dilemma – One of the original purposes of portfolios was to serve as a map or plan for future growth and development. Authors of paper portfolios often consider their portfolio to be "done" while electronic portfolio authors are more likely to consider their portfolios "a work in progress." Authors using generic tools have portable files that can be taken from school to school or into the workplace. Customized systems using proprietary file formats may cause users to hit a dead-end when they attempt to move their files or teacher candidates to abandon their portfolio upon graduation or the next bill to renew the service.

6. Data-aggregation dilemma - Customized portfolio systems are specifically designed to aggregate data for such purposes as program evaluation and accreditation. With that as a goal, institutional requirements may discourage portfolio authors from documenting deficiencies, despite the potential learning opportunities from a closer examination of such difficulties. [SCC2]

*Advantages and Challenges in ePortfolio Implementation*

The use of electronic portfolios offers a number of advantages over traditional paper-based portfolios, such as portability, accessibility, distribution ability, and repeatability of performances (Sheingold, cited in Barrett, 1998). With portfolios, students participate in their own assessment, rather than rely solely on a teacher's evaluation of their work (Mullin, 1998).

The ePortConsortium White Paper (2003) contends that the rise in e-learning has contributed substantially to the viability of electronic portfolio adoption. At institutions where elearning is in place, there is an existing network that can also be used for an electronic portfolio initiative. Many elearning systems use database-driven course management systems. Oftentimes, these systems capture information that can be repurposed for an electronic portfolio program. Furthermore, many of the artifacts a portfolio author may decide to use are already available in electronic formats and easily transferred to an eportfolio system. Additionally, the data aggregation capabilities already present in elearning databases and electronic portfolio systems can facilitate working with accountability mandates existing in education today.

Well-designed electronic portfolio systems facilitate ongoing dialogue between portfolio authors and their audience members. Annotation capabilities and threaded discussions allow the preservation of such dialogues for documentation of learning and evidence included in reflections. Electronic portfolios take advantage of hyperlinking to provide alternative routes through an individual portfolio. Furthermore, authentication and security practices allow an eportfolio author to determine who is able to see specific artifacts and who is denied this access.

Finally, electronic portfolios offer opportunities in the area of career development. Employees and eportfolio authors can maintain and update their personal information to showcase skills, certifications, accomplishments, and awards (ePortConsortium, 2003).

However, issues of verification must be addressed (Batson, 2002). There are foreseeable circumstances in which a portfolio reviewer, be it a potential employer or graduate school admissions counselor, would want to ensure work represented in the portfolio was actually that of the portfolio author.

Despite the numerous benefits afforded by electronic portfolios, eportfolio innovators must address a number of challenges. The authors of the ePortConsortium White Paper (2003) highlight seven areas in which challenges may arise: hardware and software, security and privacy, intellectual property and digital rights, usability, assessment, acceptance and managing expectations, and long-term maintenance.

1. Hardware and software challenges include the decision to use a generic tool or customized portfolio system as well as identifying funding for long-term licensing of such products. Further considerations include interoperability with existing systems such as student information systems and human resources system. Systems should be scalable to support further growth of the institution. Levels of expertise residing in the organization must be considered to determine development and deployment options.

2. Security and privacy issues must be addressed to determine who will access portfolio content and system data. Policies to address such concerns must be specified before extending access to external audiences such as potential employers and program evaluators. The institution's responsibilities under the Federal Educational Rights and Privacy Act (FERPA) must also be considered.

3. Intellectual property and digital rights concerns are growing every day. Issues of ownership of materials uploaded to electronic portfolios must be addressed and methods to

resolve disputes put in place. Mechanisms for verifying and preserving records of authorship should be implemented. “Fair use” guidelines must be made clear.

4. Usability issues to address include identifying the plug-ins and utilities required to use the eportfolio system, the file formats that will be supported, browsers and computer operating systems that can be used, and the bandwidth and other technologies required to create and maintain an electronic portfolio. Additionally, the structure, navigation, and system performance of the eportfolio system will enhance or detract from usability.

5. Assessment challenges include decisions on individual, course, program, and institutional assessment. Curricular and performance standards appropriate for such assessments must be identified and decisions about how assessment data is maintained must be made. Finally, decisions about who will have access to assessment data must be considered.

6. Acceptance and managing expectations is a challenge with any large-scale implementation. Managing user expectations and fostering acceptance among users are critical tasks to ensure long-term success. Clarifying expectations and responding to suggestions from a diverse user community including alumni, staff, students, evaluators, and administrators[SCC3] must be addressed.

7. Long-term maintenance issues include an author’s ongoing access to his or her eportfolios. Decisions about how and when to delete files or move them to long-term storage must be addressed. Garbage collection[SCC4] routines to delete orphan pages and dead links should be examined.

### *Important Concerns to Address*

Implementers of electronic portfolio programs must address a number of issues, including both technological and pedagogical concerns.

*Technological Concerns*

Batson (2002) has identified four areas of concern: storage, security, certification, and industry stability.

1. Storage - An organization implementing an eportfolio program must consider how work will be stored and for how long. Furthermore, multimedia and graphics files can be quite large, requiring large quantities of costly storage space. In addition, accessing older storage media is problematic. For example, machines capable of reading data stored on a 5.25" disk are rare today.

2. Security – Maintaining the security of personal information is an important consideration among information technologists today. Electronic portfolios may be containers for private information including social security numbers, grades, and intellectual property. A security breach could potentially expose the user to identity theft and an organization to a lawsuit.

3. Certification – If an educational organization intends to certify work contained in electronic portfolios is authentic, a system needs to be created enabling faculty to prevent further changes to certain artifacts and data. Authenticity is critical for effective assessment, evaluation, and credentialing.

4. Industry stability – Many companies offering electronic portfolio programs are relatively new and often small. Educational institutions making a long-term commitment to an electronic portfolio program will face tough decisions relying on new small vendors with an uncertain future.

The ePortConsortium's White Paper (2003) addressed additional concerns including system infrastructure, interoperability, and technological standards. System infrastructure

concerns examine the relationships between eportfolio systems and other campus systems already in place. A single department eportfolio system, such as University of Central Florida is undertaking Fall 2004, can be a standalone implementation with little to no impact on existing system infrastructure. While integration of an eportfolio system with a Student Information System (SIS) is achievable, it is not necessary. One advantage of a stand alone implementation is rapid deployment, however a disadvantage can be duplication of effort and content across various campus systems. Other deployment options include integrating the eportfolio system with a course management system or full integration with campus enterprise systems. An advantage to these types of deployment is a single authentication system for all campus systems. Specific security and certification [SCC5]issues can be addressed more broadly in this type of implementation. Additionally, such systems may be tightly integrated with course management systems, learning systems, grants management systems, and other campus wide systems.

Interoperability and technological standards considerations can insure eportfolio systems are able to communicate with other campus systems to receive and pass information needed by the various systems. Information requests may include access to data created by and about users, standardized data structures, and verification and digital rights management. Interoperability will also assist in managing workflow between various constituents. Adoption of technological standards can allow content to be reused, integrate data from one system into other systems, and facilitate authentication and authorization.

Usability and accessibility by "special needs" populations must also be considered. Adherence to specific document standards (i.e. PDF, jpg, etc.) can help insure archived documents can be read in the future. Investigation [SCC6]into the National Archives and Records Administration's (NARA) PDF/A standard or some other long-term archival format is important. Widespread

adoption of carefully defined technological standards can facilitate portability of eportfolios and data from one institution or one system to another. This is essential for the long-term usefulness, accessibility, and viability of electronic portfolios systems.

*Pedagogical Concerns*

Issues of validity and reliability appear repeatedly in examinations of large-scale portfolio assessment deployments (Koretz, 1998; Murphy, Bergamini, & Rooney, 1997; Stecher, 1998). Recently, Wilkerson and Lang (2003) reported on the legal and psychometric issues surrounding the use of portfolios for high-stakes assessment purposes such as teacher certification assessment. They raised important concerns about the psychometric properties of validity, reliability, absence of bias, and fairness.

Gearhart and Herman (1998) examined the social context of portfolio development. They found wide variability in how portfolios are implemented and the time teachers provide for students to receive assistance with revisions and choosing artifacts. Though such concerns are less critical for classroom assessments where a teacher understands the context in which the portfolio was constructed, this social milieu introduces reliability problems for large-scale assessments. Heller, Sheingold, and Myford (1998) examined portfolio raters and their reasoning while conducting portfolio assessment. They were specifically interested in determining when problems with the rating process introduced threats to validity. They noted raters found portfolios with uneven evidence [SCC7]were most difficult to rate.

In addition to the technological concerns of storage, security, and portability, Barrett (2002) added the pedagogical concerns of reflection, publishing, and linking and grouping to the list issues in implementing electronic portfolios. She stressed the importance of reflection to provide portfolio authors an opportunity to demonstrate achievements and to set future learning

goals and direction. Under the category of publishing, she raised issues such as the ability to individualize portfolio presentations to avoid "cookie cutter" effects and facilitate creativity. Further, she endorsed the ability to create a variety of portfolios for different purposes. Types of portfolios might include a learning portfolio focusing on the learner as the audience, a highly structured assessment portfolio to demonstrate achievement and receive faculty feedback, employment portfolios, and showcase portfolios demonstrating growth or highlighting specific achievements.

Work by Wolfe and Miller (1997) indicated teacher time and perceived difficulty in scoring are the biggest barriers to portfolio assessment and such concerns must be carefully addressed. They also noted perceived barriers decreased as teachers gained more experience with portfolios.

Kathleen Yancey (2001) wrote about the issues to be addressed in the portfolio planning process and has identified six critical issues, both technological and pedagogical. These included storage, leveraging the potential of the electronic environment, defining required technical skills for both students and faculty, determining the level of creativity to be supported (i.e. templates or individual creations), determining a schedule for faculty review and feedback, and defining the life of the portfolio.

### *Developing Portfolios*

To understand the technological and pedagogical considerations associated with developing electronic portfolios, interested parties can review work from the traditional paper portfolio movement. Burke, Fogarty, and Belgrad (1994) have elaborated on a 10-phase portfolio development process (see Figure 1). Briefly, those phases involve:

- Project the purposes and uses of the portfolio to be developed.

- Collect and organize the artifacts to include in the portfolio. A variety of organizational schemes and devices are appropriate.
- Select the artifacts to be included. Selections may be based on general guidelines.
- Interject the personality of the portfolio author by color selections, choices regarding page layout, or setting the mood or tone.
- Reflect metacognitively. This involves descriptions of each artifact to help the portfolio reader understand the importance of the selected artifact and how that artifact fits into the overall portfolio and portfolio goals.
- Inspect and self-asses goals. This is an examination of the overall portfolio to determine what, if any, material must be added or re-aligned.
- Perfect, evaluate, and grade (if you must). In this stage, portfolio authors add the finishing touches and prepare the portfolio for the next stage. Teachers may choose to grade a portfolio at this stage.
- Connect and conference. Considered by Burke, Fogarty, and Belgrad to be a critical stage in the assessment process, the portfolio conference allows portfolio authors to share their work with parents and receive critiques from others.
- Inject and eject. It is in this stage that the portfolio author performs ongoing maintenance and updating of his or her portfolio. New materials are added and obsolete materials are removed.
- Respect accomplishments and show with pride. In this ongoing stage, portfolio authors can show their portfolios to others. Such exhibitions offer insight about the portfolio author to portfolio viewers.

Barrett (2001a) views "portfolios as a process rather than a product – a concrete representation of critical thinking, reflection used to set goals" (p. 1). She situates her discussion of developing electronic portfolios in two bodies of literature – that of portfolio development and of multimedia development. Barrett (2000) developed a five-stage model of electronic portfolio development based on these discussions.

The first stage defining the portfolio context and goals. In this stage, the portfolio author must identify the purpose and audience for the portfolio, the goals or performance standards that will provide the organizing framework for the portfolio, and identify the software to develop the portfolio.

The second stage is a working portfolio. In this stage, the portfolio author uses the selected software to collect digital artifacts representing achievements and efforts. The third stage is the reflective portfolio in which the learner chooses specific artifacts to be included in the portfolio and completes reflections. Care must be taken to protect the privacy of these reflections as appropriate[SCC8].

The fourth stage, the connected portfolio, is unique to the electronic portfolios in that it allows the portfolio creator to insert hyperlinks to various documents and artifacts to create additional meaning. Documents are hyperlinked in a way that allows navigation. All artifacts have been inserted into the document and the portfolio is ready to present to others. The fifth and final stage is the presentation portfolio. In this stage, the portfolio is shared with appropriate audiences in a medium of the learner's choosing. Some are published on the Internet, CD, or video. At this stage, some advocate using student-led conferences or interviews to present the portfolio to the appropriate audience (Lyons, 1998; Shulman, 1998; Snyder, Lippincott, & Bower, 1998).

Figure 1 illustrates the authors' attempt to reconcile the portfolio development model suggested by Barrett (2000) and Burke, Fogarty, and Belgrad (1994). We have embedded these stage models in the pedagogical and technological considerations derived from the literature to facilitate discussions between those with a pedagogical interest in using portfolios and those working to develop and implement technical solutions.

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## *Developing Eportfolio Tools*

Today's discussions about eportfolio tools involve the technical community and the academic community. At times, commonly used terms have different meanings in the different communities. Usage of these terms appears to be imprecise and these authors believe discourse can be enhanced by a clarification of the terms.

### *Standards vs. Requirements*

A number of organizations are currently trying to define standards and requirements for electronic portfolio systems. The term "requirements" is ambiguous. Members of the instructional community speak of requiring a certain number of artifacts, or a certain type of artifact to provide evidence of specific competencies. In the technical community, the term "requirements" refers to a list of things adopters want the system to be able to do.

The term "standards" also has multiple meanings. In the context of instruction, "standards" are typically promulgated by an external organization such as an accrediting body, a department of education, or professional organization. In the technical community, a "standard"

means a rule or description to which other things must conform. Examples include units of measurement (inch, pound, or hour) or specific protocols (Ethernet or VHS).

Such technical standards are typically owned, controlled or defined by a specific organization. For example, the Institute of Electrical and Electronics Engineers (IEEE) defines many of the standards associated with computer networks. Product manufacturers adhere to these standards to ensure Toshiba, Dell, IBM, and Apple computers can share data on the same network.

Similarly, networking companies adhere to standards to allow various products to interoperate. For example, IEEE's 802.11 standard specifies requirements to insure the interoperability of wireless networking. As a result, wireless access points and wireless network cards manufactured by a number of different companies can all work on the same network. The first author's Apple AirPort card, her professor's Cisco wireless networking card, and her friend's Netgear wireless networking card all allow wireless access to the UCF wireless network. The brand of the university's wireless access point is unknown and unimportant from a user perspective. The products all work together (a user requirement) due to meeting certain specifications (a standard).

*Open Source and Open Standards*

Open source is increasingly visible in today's higher education institution. The open source software movement has provided successful software projects including Linux, Apache, OpenOffice, and Sakai. The open source software movement is based on the wide distribution of source code, enabling any programmer to make improvements and modifications for further distribution. Such software is typically provided at no cost, or for nominal fees. However, this is not always how the term "open source" is used. Some proprietary vendors make their source

code available to customers for increased customization and improved interoperability. It is still considered by many to be open source software because the source code is open.

Open standards, such as Shareable Content Object Reference Model (SCORM) are generally driven by organizations attempting to define protocols to increase interoperability of systems. Such organizations include IMS Global Learning Consortium, Advanced Distributed Learning (ADL) network, and the IEEE Learning Technology Standards Committee.

Over a period of six years, the University of Minnesota developed an electronic portfolio system for use by students, faculty, and staff. Recently, the code for this system was donated to the Open Source Portfolio Initiative (OSPI), a collaborative effort to create an electronic portfolio system by the open source software community (Treuer & Jenson, 2003). According to the Open Source Portfolio v. 2 Concept Paper (OSPI, 2003), efforts to further develop this code place interoperability and adherence to industry standards as a high priority. Similarly, the ePortConsortium (2003) advocates for adherence to open standards.

As electronic portfolio adopters begin to consider the eportfolio tools they will use, a decision about open source and open standards is necessary. James Dalziel (2003) examines these two movements and the interactions between them. The decision is not an easy one, involving tradeoffs that must be considered carefully.

### *Evaluating ePortfolio Tools*

The discussion in this paper thus far has focused on describing and defining terms associated with electronic portfolios. With the foundation for decision-making laid, the remainder of the paper addresses how an eportfolio implementer can evaluate and select eportfolio tools.

Eportfolio adopters must carefully examine their context and requirements to develop criteria against which to evaluate eportfolio systems. Gibson and Barrett (2002) offer 10 broad criteria to consider when comparing the generic tools approach to the customized system approach. Those 10 criteria are:

1. Planning and goal setting – A portfolio can be used as a tool for portfolio authors and advisers to set future goals and plan further learning experiences. In a customized system, this process may be prompted by the system and facilitated by documentation of conversations and linking to potential goals and standards.

2. Framework for creativity – A portfolio reflects the creativity and personality of the author. Considerations under this category include the electronic portfolio author's ability to individualize the portfolio using the tools at hand. A portfolio author using generic tools is only limited by the author's skill with the tool. Customized systems may offer few, if any, choices for structure and appearance.

3. Communications – Planning, developing, and publishing an electronic portfolio requires communication between the portfolio author and a mentor or adviser. An electronic portfolio system should be evaluated for capabilities to support this ongoing dialog.

4. Collaboration tools – Examples of collaborative tools include threaded discussions and whiteboards. Electronic portfolio systems support collaboration to varying degrees.

5. Reflective process – An electronic portfolio should support learner reflections. Multiple audiences need to be accommodated which will likely involve addressing security concerns.

6. Connection capabilities – An electronic portfolio must have the capability to link various work products and reflections. The system should support linkages for multiple purposes and multiple audiences.

7. Organizational flexibility – Electronic portfolios should be organized in flexible ways to accommodate multiple views, purposes, and audiences.

8. Display flexibility and transportability – Portfolio authors should be able to display their electronic portfolios in various ways. Proprietary display systems will limit this flexibility.

9. Data and information – Data and information may be aggregated to support program evaluation, accreditation, and curricular decision-making. Data collection efforts must consider privacy and confidentiality concerns of electronic portfolio authors.

10. Start-up costs and maintenance – Start-up costs and long-term maintenance needs must be calculated to determine if the portfolio system is cost-effective.

Additionally, eportfolio adopters will wish to review a variety of requirements and standards proposed by various groups. Adherence to certain technical standards may form the basis of some requirements against which an electronic portfolio system must be evaluated prior to adoption. Lists of such standards can be found in Treuer and Jenson (2003), as well as the ePortConsortium White Paper (2003).

### *Consumer's Guide to Selected Electronic Portfolio Systems*

To analyze four e-Portfolio systems (or assessment management systems), from a consumer's perspective, the authors used the system based on several assumptions about the institution environment and institutional goals, the system users, and the targeted audiences. The eportfolio systems selected for further investigation were *LiveText*, *TaskStream*, *The OSPI*, and *Chalk and Wire*.

*Assumptions about institutional environment and goals*

Implementation of the eportfolio system would take place in a higher education institution with at least bachelor and masters programs in multiple disciplines. The authors assumed the organization required an electronic portfolio system capable of integrating with existing student and course management systems, hardware, and software, as well as meeting the diverse present and future needs of faculty, students, and the community. However, the authors did not review interoperability with other systems.

The authors assumed the institution provided on-campus computer access and a computer network to faculty and students. The computer hardware specifications assumed at least 256 megabytes of RAM, a 20 gigabyte hard drive, a microphone and speakers, a scanner, a read/write CD or DVD drive, a floppy drive, a high-speed USB port, and Internet access. Installed computer software was assumed to include an office suite application (i.e., word processor, spreadsheet, and presentation tools), Internet browser, Adobe Acrobat reader, and other freeware necessary to view some Internet documents and Web sites. Minimal graphic software tools (i.e., paint, Netscape Communicator, etc.) were also assumed to be available.

The institution's document management and storage systems assumed access through Internet or network to a central server, either located at the institution or through the service provider, and the e-portfolio system would need to provide a method for organizing and maintaining digital artifacts.

*Assumptions about system users*

For this evaluation, the authors envisioned two primary audiences: instructors and students. To conduct the evaluation, we assumed both instructors and students were proficient in performing basic tasks in word processing and spreadsheet software, e-mail, and Internet

browsing and therefore capable of entering data into a pre-designed form and uploading various document formats (e.g., doc, xls, pdf, ppt, jpg, etc.) to create an artifact database.

From the instructor's perspective, the purpose of the e-Portfolio is to demonstrate the student's learning and growth as he/she progresses through the program. As an assessment tool, the eportfolio also provides physical evidence of knowledge and skills gained, as well as reflections of the learning experience and interpretation of learning and skill development. The instructor requires an eportfolio system providing the student flexibility to creatively demonstrate accomplishments, as well as development of evaluation rubrics based on program standards and generation of both individual and aggregated assessment data for student achievement of standards reports. Instructors also desire the option of developing and presenting a collection of exemplary portfolio artifacts for illustrative purposes.

Although the student may recognize the value of the instructor's application of e-Portfolios in learning, his/her perspective also focuses on future employment application. The student requires an e-portfolio system providing flexibility and creativity to effectively market him/herself. Students need to be able to publish the portfolios for presentation in a variety of formats: hard copy, videotape, DVD, CD-ROM, and Internet.

In terms of context, the authors assumed the eportfolio system would typically be used as part of classroom instruction. As such, professors and instructors provide criteria and standards to use when selecting artifacts to include in the portfolio, along with a rubric explaining how the portfolios would be evaluated. The authors assumed the e-portfolio system would need to have both public and private student self-reflection areas, including documentation of future learning goals. Likewise, a need for the system to provide for confidential feedback from instructors was an assumed functionality.

*Assumptions about portfolio audiences*

Generally speaking, the authors assumed the audience to receive a complete eportfolio would be individuals from a higher education institution, instructors, students, their families, and potential employers. At a minimum, all members of the targeted audiences had access to a computer with Internet access or a CD or DVD player. Software requirements included an office application suite, Adobe Reader, and a web browser.

Although cost was a primary factor in the institution's decision criteria, faculty and student usability was more critical. The criteria used to evaluate e-portfolio system usability originated from work by Gibson and Barrett and included:

- Planning and goal setting: Students' portfolios can easily be evaluated against a variety of standards templates.
- Creativity ability: Students can creatively build and edit portfolios to best illustrate their individuality.
- Facilitated communications between instructor and student: System can provide internal message system, as well as options for instructors and peers to comment on each other's work.
- Collaboration tools: System can provide collaborative learning and online collaboration opportunities among peer and support circles.
- Support for reflective processes: System offers areas for students to communicate reflective aspects of projects, assignments, and courses.
- Connection and linking capabilities: System can provide methods for linking assignments, reflections, and other creative work products to tailor the portfolio for different audiences.

- Organizational flexibility: System can provide opportunities for reframing portfolios for different applications and situations.
- Display flexibility and transportability: Eportfolio can transfer to other formats and platforms.
- Data and information: System can provide a variety of customizable and formatted reports generated by authorized users.
- Start-up costs and maintenance: System start-up costs and ongoing maintenance are minimal due to ease of system administration. System administration can provide ability to associate users and courses; allow users to set-up and edit course profiles; offer a robust, useful, and accurate help system, providing clear directions regarding system features and use; enable departments to customize the system for unique purposes.
- The authors of this paper added system functionality and usability: Students can log in and out of the system easily; determine which system's options are available for their use; select user profiles and types; easily create, organize, and upload work online; submit assignments online. Instructors can easily create assignments online, providing corresponding instructions and assignment details. System security features are available and easy to apply by both instructors and students.

*LiveText*

| Criteria | Results |
|---|---|
| Planning and goal setting | Instructors have convenient access to a wide variety of standards which can be used to create individual or institution-wide rubrics for evaluating student portfolios. |
| Creativity ability | Limited creativity is supported with the ability to upload and incorporate images. Images can be placed above or below text, or to the left or right of text, depending on the user's wishes. The Java editor offers user control on heading type, a limited font selection, styles (bold, italic, underline), a small color palette, and access to bulleted and numbered lists. Six site theme colors are available: sage, lilac, classic blue, cranberry, grape, and sunset. The selected theme is applied across the entire site, not just one portfolio. |
| Facilitated communications between instructor and student | Portfolios can be shared between instructors and students. The instructor receives portfolios for review in a section of "My Desk". Rubrics to evaluate specific documents or portfolios in general are available at the institutional level or can be created by individual instructors. These rubrics offer commenting capabilities. Users can enable discussion threads on each page. |
| Collaboration tools | The user can enable discussion threads on each page. Students can share their portfolios and documents with instructors, peers, and visitors. Commenting is supported. |
| Support for reflective | Institutions can create sample reflections or instructions for |

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| processes | reflections within templates. These can be modified by the user for individual use. Artifacts can be attached or linked to the reflections. |
| Connection and linking capabilities | Linking capabilities are good, supporting links to documents both internal and external to the system. LiveText also supports attachments. |
| Organizational flexibility | [SCC9]Permits creation of courses, lesson plans, portfolios, and projects; User can create multiple instances of each project type and link from one component to another. Supports multiple portfolios with user-defined sections in each. Also allows institutions to create templates for users to modify as needed. |
| Display flexibility and transportability | Offers option to print, permitting selection and preview of print job. Also exports files to a zipped html archive of documents, images, and attachments. LiveText branding is removed and users can work with CSS to apply a new look to their work. |
| Data and information | LiveText is strong in this area, collecting and aggregating data across professors for use in the accreditation process. |
| Start-up costs and maintenance | Start-up cost is $79 or $99 per student, depending on package selected; maintenance $5/month after graduation. Cost is shifted to the student. |
| System functionality and usability | Login and logout is easy. Availability of options is readily apparent. Uploading work is easy. Sharing work with others is not difficult; the default security settings protect individual work. The system is complex enough to be daunting to the novice user. Highly proficient |

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| | users should be able to figure out the system fairly easily. On the Macintosh platform, the biggest usability problem is “bugginess” with at least one bug resulting in lost and irretrievable data. |

Bugs encountered:

Loading Preview – While creating a new portfolio and choosing a template, the first author saw a message LiveText was loading a preview. The preview never loaded. The author attempted loading twice using IE 5.2 on Mac OS 10.3.5 with 640 MB of RAM.

Java Editor – Scrolling through long documents resulted in erratic behavior, making it difficult to select large blocks of text (for example, to change fonts). Apostrophes and quotation marks regularly turned into question marks, probably due to copy and paste procedures.

*TaskStream*

Another e-Portfolio system evaluated based upon the above criteria was TaskStream (http://www.taskstream.com). The opening screen for TaskStream provides a logical, organized view of the system tools and features, making it extremely user friendly.

| Criteria | Results |
|---|---|
| Planning and goal setting | TaskStream offers a wide variety of standards for aligning student portfolios with the curriculum, as well as tracking standards and generating reports. |
| Creativity ability | Due to the templates offered through TaskStream, students have limited creativity options for displaying and demonstrating work. |
| Facilitated communications between instructor and student | TaskStream offers an internal messaging system for direct communication between the instructor and students. New messages are indicated by a blinking "New Message" icon in the upper right corner of the screen. |
| Collaboration tools | TaskStream allows students to share their e-Portfolios with other students, both within the system, as well as external e-mail. Based upon the level of access provided, students could collaborate to create a portfolio assignment for a given class. |
| Support for reflective processes | TaskStream provides a text box for student reflection at the time the student is uploading the artifact. Students can upload additional documents to support their reflective comments. |
| Connection and linking capabilities | Although TaskStream offers opportunities for providing links to other online work, as well as uploading work, limited interaction can |

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| | be created between and among work products. |
| Organizational flexibility | TaskStream appears to offer some flexibility for reframing portfolios for a variety of applications (e.g., school, job search, etc.) through the "Publish/Share" option. |
| Display flexibility and transportability | Student portfolios are created and maintained on the TaskStream system. Although the uploads and links could be transported to other e-Portfolio systems, students would basically be re-creating their portfolios on the new system. |
| Data and information | TaskStream offers a variety of formatted, printable reports. |
| Start-up costs and maintenance | TaskStream provides system administration options to both instructors and students. Students can associate, set-up, and edit course profiles. The help system is useful and comprehensive, providing easy to follow directions regarding system features and use. System customization by different departments for unique purposes is possible based on standards and template options |
| System functionality and usability | TaskStream is relatively easy to access (logon) and provides a comprehensive view of system options on the entry screen. Instructors and students can easily determine and select user profiles and types, as well as system security features. Both instructors and students can easily create, organize, and upload assignments and work online, as well as provide corresponding instructions and assignment details. |

*Open Source Portfolio Initiative (OSPI)*

The OSPI follows a three-step process (enter, share, view) for portfolio development. This simple sequence makes the system useable, but many will find themselves constrained by inflexible organizational capabilities.

| Criteria | Results |
|---|---|
| Planning and goal setting | Not available |
| Creativity ability | There is little flexibility permitted for individuals. The default version 1.5 only permits individuals to show or not show a specific element. There is one template available. |
| Facilitated communications between instructor and student | Commenting features are enabled by default, offering opportunities for students and peers to comment on work. The notification system doesn't work – at least not on the Macintosh using Mozilla or IE. |
| Collaboration tools | The only collaboration tools available are the commenting tools. |
| Support for reflective processes | Support for reflection is adequate. With customization by the institution, models of reflection can probably be provided and edited by individuals. |
| Connection and linking capabilities | Connection and linking capabilities are "buggy." The material manager permits users to upload and organize a variety of file types and URLs. These can then be attached to various portfolio elements. However, viewing these artifacts in preview mode generates error messages in both IE and Mozilla on a Macintosh. |

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| Organizational flexibility | The default installation of the OSPI offers no flexibility for individual users. Because the system is Open Source, institutions with sufficient technical expertise on staff can substantially customize the system, but these customizations are unlikely to result in a highly customizable system for the end user. |
| Display flexibility and transportability | The system purports to offer the capability of downloading user portfolios. The first author couldn't make this work on her Macintosh. IE wouldn't allow me to download. Mozilla allowed the download, but then the resulting zip file would not extract. |
| Data and information | Not available. |
| Start-up costs and maintenance | Start-up and maintenance costs will vary widely depending on an institution's implementation of the portfolio initiative and the in-house expertise for maintenance and configuration. Specific hardware requirements will need to be satisfied. |
| System functionality and usability | Adding an attachment in the personal information section caused the Apache server to generate an exception report in both Mozilla and IE. |

*Chalk and Wire*

One of the e-Portfolio system's evaluated based upon the above criteria was Chalk and Wire (www.avenet.net). Although Chalk and Wire has a relatively user friendly e-Portfolio system, some aspects of the system were not effective.

| Criteria | Results |
|---|---|
| Planning and goal setting | Due to the structure of the Chalk and Wire system, students' portfolios could be easily evaluated based upon the desired standards. |
| Creativity ability | Chalk and Wire did not provide very much flexibility for student creativity. Students can select templates based on a few standard system templates or upload their own. Students can select photographs and illustrations from a few system standards or upload their own. Students are unable to move text boxes or display assignments or work products except in the format prescribed by the system. |
| Facilitated communications between instructor and student | Chalk and Wire does offer an internal messaging system for direct communication between the instructor and students. |
| Collaboration tools | Chalk and Wire does allow students to share their e-Portfolios with other students. Based upon the level of access provided, students could collaborate to create a portfolio assignment for a given class. |
| Support for reflective | Chalk and Wire provides a text box for student reflection. Students |

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| processes | can upload additional documents to support their reflective comments. |
| Connection and linking capabilities | Although Chalk and Wire offers opportunities for providing links to other online work, as well as uploading work, limited interaction can be created between and among work products. |
| Organizational flexibility | Chalk and Wire offers limited flexibility for reframing portfolios for a variety of applications (e.g., school, job search, etc.). |
| Display flexibility and transportability | Student portfolios are created and maintained on the Chalk and Wire system. Although the uploads and links could be transported to other e-Portfolio systems, students would basically be re-creating their portfolios on the new system. |
| Data and information | Chalk and Wire produces a variety of formatted, printable reports. |
| Start-up costs and maintenance | Chalk and Wire limits students' ability to associate, set-up, and edit course profiles. The help system is useful, however, not as robust as many users may need. The directions regarding system features and use are clear, however, not as comprehensive as may be desired. System customization by different departments for unique purposes appears limited. |
| System functionality and usability | Although it is relatively easy to logon to Chalk and Wire, logging off and determining which system's options are available for use are not readily apparent. Selecting user profiles and types, and determining system security features, also are not easily identified or applied. However, students can easily create, organize, and upload |

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| | work online, as well as submit assignments online. Also, instructors can easily create assignments online, providing corresponding instructions and assignment details. |

*ePortfolio Resources*

This final section of the paper contains web addresses and brief descriptions of some of the best Internet resources on the subject of electronic portfolios. Links to publications and organizations are included.

*ElectronicPortfolios.org* at http://www.electronicportfolios.org/ – Compiled by Dr. Helen Barrett, an expert on electronic portfolios, this web site offers links to presentations, papers, and how-to guides to develop electronic portfolios using generic tools. Of particular interest is the link to the Apple Learning Interchange exhibit at http://ali.apple.com/ali_sites/ali/exhibits/1000156/.

*National Learning Infrastructure Initiative* at http://www.educause.edu/nlii/keythemes/eportfolios.asp#resources identifies electronic portfolios as a key theme. Their web page links to a variety of references and resources on the topic, including conference presentations.

ePortConsortium.org at http://www.eportconsortium.org/ – A white paper published in November, 2003, by this consortium of institutions is downloadable from their site. Additionally, the References page of their web site links to a variety of eportfolio projects, software, papers, and activities.

Electronic Portfolio Action Committee (EPAC) Virtual Community of Practice (VCoP) at https://worktools.si.umich.edu/workspaces/dcamrid/002.nsf - The EPAC VCoP offers a forum

for scholars, thinkers, and innovators to discuss electronic portfolios in higher education. The American Association of Higher Education (AAHE) sponsors this VCoP. Organizational membership is required.

Also from the AAHE, the Portfolio Clearinghouse at http://www.aahe.org/teaching/portfolio_db.htm provides a searchable database of electronic portfolio projects from a global audience.

Sponsored by the Carnegie Foundation, the Knowledge Media Laboratory at http://kml2.carnegiefoundation.org/html/gallery.php offers 25 examples of teaching portfolios created by K-12 teachers and those in higher education. Examples come from a wide variety of disciplines.

### *Summary*

Eportfolio implementers face a number of important decisions. The system selected impacts both the pedagogical and technological environments at the institution. Carney's (2002) dilemmas illustrate the difficulty of the decision-making process for instructional leaders. Shulman (1998) also warns about five dangers of using portfolios: they become mere exhibitions; they are difficult to complete; the consequences of trivialization; the possible perversion of the process; and the possibility of misrepresentation. Instructional leaders must guard against these dangers and continue to advocate for the pedagogical goals of electronic portfolios or risk being overtaken by high-stakes assessment and accreditation goals of administrators, accreditation organizations, and evaluators. Furthermore, the trend to aggregate data carries ethical considerations and offers potential for abuse that must be weighed carefully.[SCC10]

Technology leaders have an equally imposing set of challenges to face. The lack of defined standards in the industry pose special challenges for ensuring scalability and integration with legacy systems. The Open Source movement offers a viable, if non-traditional, option for institutions with substantial in-house expertise.

A number of customized systems are available, at a price, to facilitate a non-technical user in creating and assessing an electronic portfolio. The electronic portfolio industry is still in a nascent stage, so one can expect a number of significant changes to both commercial and non-commercial offerings. It is essential curricular, pedagogical, and administrative leaders meet with software developers to educate them about the how eportfolio systems should be developed[SCC11]. The OSPI and EPAC communities encourage scholars to become involved and guide their development efforts. Curriculum and pedagogy experts must involve themselves in this discussion to influence eportfolio development efforts.

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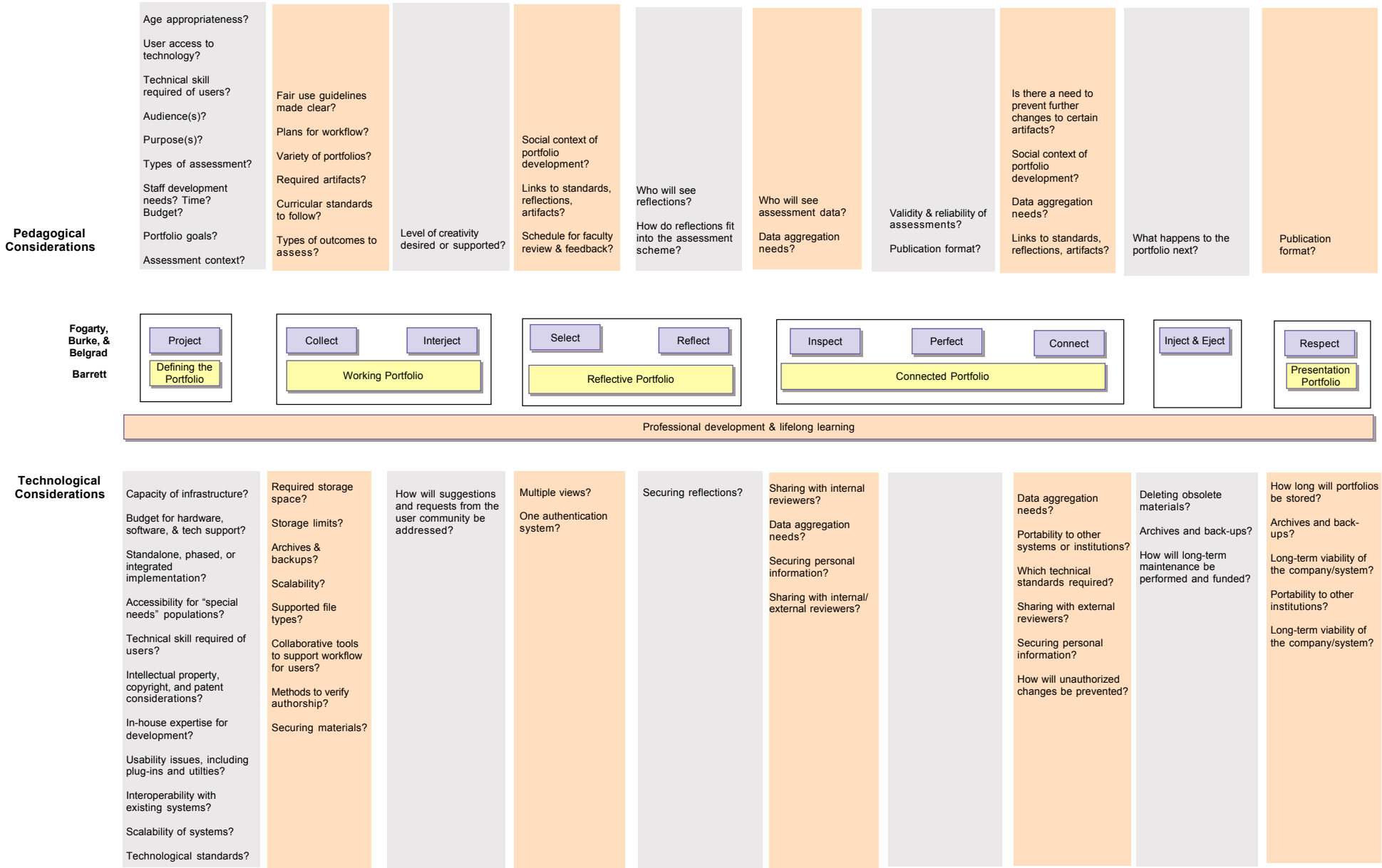


**Figure 1. Model of Electronic Portfolio Development Process based on work by Dr. Helen Barrett**