

Selecting the software and approach to creating an electronic portfolio

There are many strategies for developing electronic portfolios, and they appear to fall under two general approaches: the **common tools approach** or using off-the-shelf software, and the **customized systems approach** which involves designing a networked system or buying a proprietary software package or online service.

Common tools approach: Portfolios are developed with reflections and artifacts that more closely emulate the traditional 3-ring binder. The portfolio's structure is imposed by the learner or the software for maximum flexibility and creativity. There is a relatively low cost for equipment or software, but there may be a higher cost for training. Student can continue developing their portfolio once out of the educational system.

There are some very good commercial electronic portfolio programs on the market, although they often reflect the developer's style or are constrained by the limits of the software structure. Many educators who want to develop electronic portfolios in the classroom or for themselves tend to design their own, using off-the-shelf software, or generic strategies. The most common tools are: relational databases, hypermedia "card" software, multimedia authoring software, World Wide Web (HTML) pages, Adobe Acrobat (PDF files), Office Suite software, multimedia slide shows, and digital or analog video.

Customized systems approach: Portfolios are also developed as online record-keeping systems that can be used to collect reflections and artifacts. They are usually highly structured using an online database, leaving the learner with limited flexibility and creativity. There is a high cost for equipment, network server and software development. There may be a lower cost for training, depending on system design. One concern is whether the students can continue developing the portfolio once they are out of the educational system.

David Gibson has outlined many of the issues to consider when making the decision as to which approach best meets out needs: <http://helenbarrett.com/EPDirections.pdf>

The National Learning Infrastructure Initiative will be developing specifications for developing online electronic portfolios. Watch their website at: <http://www.educause.edu/nlii/>

Pedagogical Issues

Here are some of the pedagogical issues to consider, regardless of the approach you take. An online portfolio system needs to support a culture of EVIDENCE:

Evidence = Artifacts + Learner Reflections + Validation or Feedback

Below are some of the requirements for creating an online portfolio based on the pedagogical requirement of a PORTFOLIO system (whether paper-based or electronic).

Storage Space:

- To store digital artifacts (with meta-tags)
- To store learner self-reflection and self-assessment on each artifact
- To store feedback on each artifact from assessor(s) (independent validation)
- To store details of the assignment with criteria for assessment (rubrics)

Security:

Ability to restrict access, setting permissions to view:

- Artifact only
- Artifact with reflection
- Artifact with reflection and feedback

Ability to set permissions separately for faculty to view portfolio and provide feedback on work.

Linking and Grouping:

Ability to organize portfolio in a variety of ways (flexibility in organization)

- By standards or learning outcomes
- By course
- By date (entered, last updated, etc.)
- By status of work (Work in progress, ready for assessment, ready for publication)

Ability to include:

- Goals for portfolio, Contents of portfolio
- Learning Goals or Standards
- Resume

Reflection:

Ability to reflect on a specific grouping of artifacts to make a particular case (i.e., how this collections demonstrates achievement of a standard or learning goal)

Ability to set learning goals and future direction

Publishing

Ability to create a variety of portfolios, depending on audience and purpose:

- **Learning** portfolio (a reflective journal with artifacts; primary audience is the learner)
- **Assessment** portfolio (a highly-structured portfolio demonstrating achievement of learning goals or standards, with independent validation and feedback on artifacts/reflections from faculty)
- **Employment or Marketing** Portfolio (a semi-structured portfolio, developed for the purpose of making the case for suitability for a particular position)
- **Showcase** Portfolio (a collection of artifacts, with reflections, that demonstrate growth over time, highlighting specific achievements)

Ability to individualize the portfolio, to allow creativity of expression in the presentation (to avoid the “cookie cutter” effect or identical “look and feel” of a data-base or template-based portfolio)

Selecting the appropriate off-the-shelf software

In the October 1998 issue of *Learning & Leading with Technology*, I outlined the strategic questions to ask when developing electronic portfolios. This article describes the electronic portfolio development process further and covers seven different software and hardware tools for creating portfolios. Some very good commercial electronic portfolio programs are on the market, although they often reflect the developer's style or are constrained by the limits of the software structure. Many educators who want to develop electronic portfolios tend to design their own, using off-the-shelf software or generic strategies. Here, I discuss the structure of each type of program, the advantages and disadvantages of each strategy, the relative ease of learning the software, the level of technology required, and related issues. The seven generic types of software are:

1. Relational databases
2. Hypermedia "card" software
3. Multimedia authoring software
4. World Wide Web (HTML) pages
5. Adobe Acrobat (PDF files)
6. Multimedia slideshows
7. Video (digital and analog)

Differentiating the Levels of Electronic Portfolio Implementation. In addition to the stages of portfolio development, there appear to be at least five levels of electronic portfolio development. Just as there are developmental levels in student learning, there are developmental levels in digital portfolio development. Table 2 presents different levels for electronic portfolio development, which are closely aligned with the technology skills of the portfolio developer.

Table 2. Levels of electronic portfolio software strategies based on ease of use.

0. All documents are in paper format. Some portfolio data may be stored on videotape.
1. All documents are in digital file formats, using word processing or other commonly used software, and stored in electronic folders on a hard drive, floppy disk, or LAN server.
2. Portfolio data is entered into a structured format, such as a database or HyperStudio template or slide show (such as PowerPoint or AppleWorks) and stored on a hard drive, Zip, floppy disk, or LAN.
3. Documents are translated into Portable Document Format with hyperlinks between standards, artifacts, and reflections using Adobe Acrobat Exchange and stored on a hard drive, Zip, Jaz, CD-R/W, or LAN server.
4. Documents are translated into HTML, complete with hyperlinks between standards, artifacts, and reflections, using a Web authoring program and posted to a Web server.
5. Portfolio is organized with a multimedia authoring program, incorporating digital sound and video. Then it is converted to digital format and pressed to CD-R/W or posted to the Web in streaming format.

Software Selection

One of the key criteria for software selection should be its capability to allow teachers and students to create hypertext links between goals, outcomes, and various student artifacts (products and projects) displayed in multimedia format. Another is Web accessibility. With seven options to choose from, you should be able to find software to fit your audience, goals, technology skills, and available equipment.

Microsoft Word and Excel. The most commonly-used software today can provide a simple but powerful environment for creating electronic portfolios. Excel files allow simple database functions for listing artifacts in the collection, complete with hyperlinks to the original documents. Excel also allows comments in each field, for further explanation. Word is the ideal tool for writing reflective statements, with similar capabilities for hyperlinks and comments.

Advantages include ubiquitous access, hyperlinking capabilities, automated conversion into WWW-compatible formats, and low cost. Disadvantages include: WWW publishing requires conversion to HTML, password protection may not be available.

Relational Databases (e.g., FileMaker Pro, Microsoft Access). In recent years, new database management tools have become available that allow teachers to easily create whole-class records of student achievement. A relational database is actually a series of interlinked structured data files linked together by common fields. One data file could include the students' names, addresses, and various individual elements; another could include a list of the standards that each student should be achieving; still another could include portfolio artifacts that demonstrate each student's achievement of those standards. The purpose of using a relational database is to link together the students with their individual portfolio artifacts and the standards these artifacts should clearly demonstrate.

Advantages include flexibility, network and Web capabilities, cross-platform capabilities, tracking and reporting, multimedia, and security. Disadvantages include the size of relational database files (they can become very large and unwieldy); they may not be accessible to users who do not have the software; and they require a high level of skill to use effectively.

Databases are really teacher-centered portfolio tools. They allow teachers to keep track of student achievement at every level. They are less appropriate for students to use to maintain their own portfolios. You may save appropriate pages from the database as PDF files for students to include in their own portfolios.

Hypermedia "Card" Programs (e.g., HyperStudio, Digital Chisel, Toolbook, and SuperLink). A hypermedia program allows the integration of various media types in a single file, with construction tools for graphics, sound, and movies. The basic structure of a hypermedia file is described as electronic cards that are really individual screens that can be linked together by buttons the user creates.

Hypermedia programs are widely available in classrooms, usually all-inclusive, cross-platform, multimedia capable, and secure. Disadvantages include lack of integrated Web accessibility, size and resolution constraints, and increased effort linking artifacts to standards. Hypermedia programs are most appropriate for elementary or middle school portfolios. Templates and strategies are widely available to help you begin using your chosen hypermedia tool as a portfolio development and assessment tool.

Multimedia Authoring Software (e.g., Macromedia Director or Authorware). In recent years, multimedia authoring software has emerged from such companies as Macromedia and mTropolis. Authorware is an icon-based authoring environment, in which a user builds a flow chart to create a presentation. Director is a time-based authoring environment, in which the user creates an interactive presentation with a cast and various multimedia elements. Both programs allow the user to create stand-alone applications that can run on Windows and Macintosh platforms.

These programs allow users to create presentations that are self-running, without separate player software. They were designed to incorporate multimedia elements. They are ideal for CD-ROM publishing, but they have a steep learning curve, require extra effort to link artifacts to standards, and may not offer the necessary security. Multimedia authoring programs would be most appropriate for high school, college, or professional portfolio creation.

Web Pages (e.g., Adobe PageMill, Claris Home Page, Microsoft FrontPage, Netscape Composer). An emerging trend in the development of electronic portfolios is to publish them in HTML format. With wide accessibility to the Web, many schools are encouraging students to publish their portfolios in this format. Students convert word processing documents into Web pages with tools built into those programs and create hyperlinks between goals and the artifacts that demonstrate achievement.

The advantages of creating Web-based portfolios center on its multimedia, cross-platform, and Web capabilities. Any potential viewer simply needs Internet access and a Web browser. However, the learning curve is steep. Web pages require much more file-management skill than other types of portfolio development tools, and the security can be a problem. Students in upper-elementary grades and beyond can create Web pages, but this type of portfolio is especially appropriate for those who wish to showcase their portfolio for a potential employer.

PDF Documents (Adobe Acrobat). One of the more interesting development environments for electronic portfolios is Adobe Acrobat's Portable Document Format (PDF). PDF files are based on the Postscript page layout language originally developed for printing to a laser printer. PDF files are created using the tools provided by Adobe, either the PDF Writer or Distiller program. Adobe Acrobat files are called Portable Document Format because the same file can be read by a variety of computer platforms and require only the free Acrobat Reader software. The process of creating an Acrobat file can be as easy as printing to a printer; in fact, the PDF Writer is a printer driver that is selected when the user wants to convert a document from any application into a PDF file. Another software package, PrintToPDF, is a less powerful shareware Macintosh printer driver that creates simple PDFs for a much lower price (\$20).

Once a PDF file is created, the user can navigate page by page, by using bookmarks they create, or with hypertext links or buttons they can create with the Acrobat Exchange program. My own electronic teaching portfolio is published on CD-ROM with Adobe Acrobat.

PDF files are easy to access and read, can be created from multiple applications, include multimedia elements, are easily published to CD-ROM, have few size and resolution constraints, and are secure. Disadvantages include the large file size, the need for separate creation software, and the effort required to link artifacts to standards. Students at all levels can create PDF files, but it is a more appropriate tool for high school and older students.

Multimedia Slideshows (e.g., AppleWorks and PowerPoint). These programs allow the user to create electronic slideshows most often shown in a linear sequence. Most of these tools allow the integration of sound and video, and Microsoft PowerPoint allows some buttons and links. Other software can also be used to create electronic portfolio documents, such as a word processor or spreadsheet.

Advantages of multimedia slideshows include the easy access to the software and its multimedia capabilities. But, it is challenging to link artifacts to standards, files can be very large, Web publishing requires conversion to HTML, password protection may not be available. Multimedia slideshows are most appropriate for middle school and older students.

Video (digital and analog). Digital video can be a powerful addition to many of the other portfolio development tools outlined here. Nonlinear digital video editing could be used to organize videotaped portfolio artifacts. Analog video can be used to gather evidence of student learning in a low-cost storage medium, and videotape is a popular final publishing medium for sharing student presentation portfolios with family and friends.

Advantages of analog video include its widespread use, cheap storage medium, acceptable quality, and relatively low-cost hardware. Analog video, however, allows only linear access, has low interactivity, offers no Web accessibility, takes a lot storage space, and is hard to edit. Digital video adds Web accessibility, high interactivity, random access, and easy editing, but also can be low quality, have huge file size and bandwidth requirements, and require expensive equipment to digitize and edit.

Video is appropriate for a wide range of students and audiences. It is the best way to capture classroom interaction, including nonverbal cues, and it is often the method by which final portfolios are shared.

Conclusion

With all of these choices, which strategy should you choose? Are different tools more appropriate at different stages of the electronic portfolio development process? These questions can only be answered after addressing some of the questions posed in Stage 1, especially the purpose and audience for the portfolio, the resources available (equipment and technology skills required), and where the advantages of the strategy outweigh the disadvantages for your situation.

Portfolio construction tools compared

| | Common Development Tools | Structure and Links | Player available | Advantages | Disadvantages | Ease of Use 1=low skill 5=high skill | Technology Required 1=low tech 5=high tech | Cost (w/ educator discounts) |
|-----------------------------|---|--|-----------------------------------|---|---|--|--|---|
| Word processor, spreadsheet | Microsoft Word, Excel | Formatted Text (word processor) Data in spreadsheet cells (columns and rows in spreadsheet) | No | ubiquitous access, hyperlinking capabilities, automated conversion into WWW-compatible formats, and low cost | WWW publishing requires conversion to HTML, password protection may not be available. | 1 | 1 | |
| Relational database | FileMaker Pro, Microsoft Access | Fields, records, or files linked by common fields | Yes | Flexible reporting, network- friendly, Web accessible, cross- platform | Size of files requires player | 4 to develop, 2 to use | 3 | \$65– 156 |
| Hypermedia | HyperStudio, Digital Chisel | Electronic cards linked by “buttons” | Yes | Widely available in classrooms, construction tools included, some software cross- platform | Not easily Web-accessible (requires browser plug- in), view limited to screen size | 3 to develop | 3 | \$39– 199 |
| Multimedia Authoring | Macromedia Authorware, Director | Icon- or time-based environment | Self-contained | Most flexibility in development, CD- ROM, cross- platform | Steep learning curve | 5 | 5 | \$128– 699 |
| Web Pages | Adobe PageMill, Claris Home Page, Composer | Pages viewed with a Web Browser (Netscape or Explorer) using links created in HTML | Browser (free) | Web-accessible, cross- platform | Multimedia (video) not well integrated, complex authoring | 2 w/ editor, 4 w/ o | 4 | Free–\$ 79 |
| Adobe Acrobat | Adobe Acrobat Exchange | Postscript-based pages that can be navigated sequentially or by using bookmarks, links, or buttons | Reader (free) | Web- accessible, cross- platform, create files, from any applications, ideal for CD ROM, can capture Web pages w/ links | Size of files, limited construction tools | 2 | 4 | \$42– 90 |
| Slide Shows/ Presentations | Microsoft PowerPoint, Works, AppleWorks | Slideshow presentation or “Binder” (Microsoft Office) to link documents together | No | Widely accessible software, cross- platform | Not directly Web-accessible, ease of creating hypertext links, requires original application to read. | 3 | 3-4 | \$46–210 |
| Digital Video | QuickTime or AVI format., Movie Player Pro (for editing), Apple Video Player, (for digitizing), Avid Cinema, iMovie | Record performances in and out of the classroom within other digital portfolio construction tools, also, digital video editing (Avid Cinema, Adobe Premiere, iMovie) can be used to prepare artifacts for presentation in analog video. | QuickTime, RealPlayer (both free) | Web access high interactivity random access, editing | File size, storage quality, bandwidth requirements, hardware requirements to digitize video | Level 5 skill needed to create digital video, although w/ tools such as Avid Cinema and iMovie, the learning curve is flatter. | 5 to use computers w/ video digitizing boards. Digital video cameras streamline the process, especially with the latest computers, which have FireWire (IEEE 1394) connections to the DV camera. | Editing software from \$29 (MoviePlayer Pro) to \$500+. DV cameras <\$ 1,000. |
| Analog Video | Video on tape: VHS, 8mm | Standard video used to capture performances in the classroom or to gather data outside; also a universal format for final presentation portfolio; sometimes the computer is used to organize and translate the portfolio back to standard video tape | All that is required is a VCR. | Ubiquitous access, cheap storage medium, acceptable quality, relatively low-cost hardware requirements | Linear access, low interactivity, no Web access, storage, editing | Level 2 skill needed to create analog video, although editing analog videotape is more complicated. | Can be recorded with low-end equipment | Other than the cost of a camera or VCR the only additional cost is for videotape. Analog video editing system cost can range from \$250 and up. Pay as little as \$300 for an 8mm camera. |

The "5-by-5" Model of Electronic Portfolio Development - Overview of Technology Options

| © 2000, Helen C. Barrett | Stages of Electronic Portfolio Development | | | | |
|--|---|--|--|---|---|
| Levels of Portfolio Development (based on level of difficulty) | <p style="text-align: center;">1</p> <p style="text-align: center;">Defining the Portfolio Context & Goals</p> <p>Identify: the portfolio's purpose and audience; the standards (goals) or organizing framework; the resources available (hardware, software, level of technology skills). Select the appropriate level/technology to begin.</p> | <p style="text-align: center;">2</p> <p style="text-align: center;">The Working Portfolio</p> <p>Identify, collect and store portfolio artifacts based on purpose/audience/goals. Interject personality into the portfolio design by using appropriate multimedia to add style and individuality to the portfolio.</p> | <p style="text-align: center;">3</p> <p style="text-align: center;">The Reflective Portfolio</p> <p>Select the artifacts that represent achievement of standards/goals. Reflect on why artifacts were selected, indicating meaning and value to the portfolio. Project learning goals for the future (direction).</p> | <p style="text-align: center;">4</p> <p style="text-align: center;">The Connected Portfolio</p> <p>Organize the digital artifacts. Create hypermedia links between goals, artifacts, reflections. Identify patterns through the "linking" process.</p> | <p style="text-align: center;">5</p> <p style="text-align: center;">The Presentation Portfolio</p> <p>Record the portfolio to an appropriate presentation and storage medium. Share the portfolio with an appropriate audience.</p> |
| <p>1 - Text only.</p> <p>All documents are in digital file formats, using word processing or other commonly-used software, and stored in electronic folders on a hard drive, floppy diskette or LAN server.</p> | <p><i>Development Software:</i> Any Word Processor</p> | <p><i>Development Software:</i> Any Word Processor</p> | <p><i>Development Software:</i> Any Word Processor</p> | <p><i>Development Software:</i> Microsoft Word (linking to other Word documents) AppleWorks (linking to other Works documents)</p> | <p><i>Storage/Publishing Tools:</i> Zip Disk or Floppy Diskette or Hard Drive or Server</p> |
| <p>2a - With Graphics.</p> <p>Portfolio data is entered into a structured format, such as a database or HyperStudio template or slide show (PowerPoint or AppleWorks) and stored on a hard drive, Zip, floppy diskette or LAN server. Video may be collected in analog form on video tape. Presentation portfolio may also be recorded on video tape.</p> | <p><i>Development Software:</i> Database PowerPoint or slide show HyperStudio</p> <p>Inspiration (mind mapping software)</p> | <p><i>Development Software:</i> Graphics software Database PowerPoint or slide show HyperStudio</p> <p>Digital still camera</p> | <p><i>Development Software:</i> Database PowerPoint or slide show HyperStudio</p> | <p><i>Development Software:</i> HyperStudio</p> | <p><i>Storage/Publishing Tools:</i> Videotape (digital-to-analog conversion)</p> |
| <p>2b - With Audio & Video</p> <p>Portfolio incorporates digitized audio and video artifacts linked to the portfolio, and stored on CD-ROM or server.</p> | | <p>Audio capturing software</p> <p>Video capturing software (analog-to-digital conversion)</p> | <p>Audio editing software</p> <p>Video editing software</p> | | <p><i>Storage/Publishing Tools:</i> CD-ROM</p> |
| <p>3 - With Navigational links</p> <p>Documents are translated into Portable Document Format with "hyper-links" between standards, artifacts, and reflections using Adobe Acrobat Exchange and stored on a hard drive, Zip, Jaz, CD-R/W, or LAN server.</p> | | <p><i>Conversion Software:</i> Adobe PDFWriter or PrintToPDF (Mac only) Acrobat Distiller</p> | | <p><i>Development/Editing Software:</i> Adobe Acrobat Exchange</p> | <p><i>Storage/Publishing Tools:</i> CD-ROM</p> |
| <p>4 - With WWW links</p> <p>Documents are translated into HTML, complete with "hyper-links" between standards, artifacts, and reflections, using a web authoring program (i.e., Netscape Composer, Adobe PageMill or CyberStudio, Macromedia Dreamweaver) and posted to a WWW server.</p> | | <p><i>Development & Publishing Software:</i> HTML authoring software</p> | <p><i>Development & Publishing Software:</i> HTML authoring software</p> | <p><i>Development & Publishing Software:</i> HTML authoring software</p> <p>PowerPoint*</p> | <p><i>Storage/Publishing Tools:</i> WWW Server</p> |
| <p>5 - With Interactive Multimedia</p> <p>Portfolio is organized with a multimedia authoring program, incorporating digital sound and video is converted to digital format and pressed to CD-R/W or posted to WWW in streaming format.</p> | | <p><i>Development & Publishing Software:</i> Macromedia Director</p> | <p><i>Development & Publishing Software:</i> Macromedia Director</p> | <p><i>Development & Publishing Software:</i> Macromedia Director</p> | <p><i>Storage/Publishing Tools:</i> Streaming Server</p> |