Create Your Own Electronic Portfolio

Using Off-the-Shelf Software to Showcase Your Own or Student Work

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Published in *Learning & Leading with Technology* , April, 2000

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)

Why Portfolios?

Portfolio assessment has become more commonplace in schools because it allows teachers to assess student development over periods of time, sometimes across several years.

People develop portfolios at all phases of the lifespan. Educators in the Pacific Northwest (Northwest Evaluation Association, 1990), developed the following definition of portfolio.

> 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, the criteria for selection; the criteria for judging merit, and evidence of student self-reflection.

Electronic Portfolios. My definition of *electronic portfolio* includes the use of electronic technologies that allow the portfolio developer to collect and organize artifacts in many formats (audio, video, graphics, and text). A *standards-based electronic portfolio* uses hypertext links to organize the material to connect artifacts to appropriate goals or standards. Often, the terms *electronic portfolio* and *digital portfolio* are used interchangeably. However, I make a distinction: an electronic portfolio contains artifacts that may be in analog (e.g., videotape) or computer-readable form. In a digital portfolio, all artifacts have been transformed into computer-readable form. 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.

Electronic Portfolio Development

Electronic portfolio development brings together two different processes: multimedia project development and portfolio development. When developing an electronic portfolio, equal attention should be paid to these complimentary processes, as both are essential for effective electronic portfolio development. (See the online supplement at www.iste.org/L&L for a complete discussion of these processes.)

Danielson and Abrutyn (1997) lay out a process for developing a portfolio:

1. Collection: The portfolio's purpose, audience, and future use of the artifacts will determine what artifacts to collect.
2. Selection: Selection criteria for materials to include should reflect the learning objectives established for the portfolio. These should follow from national, state, or local standards and their associated evaluation rubrics or performance indicators.
3. Reflection: Include reflections on every piece in your portfolio and an overall reflection.
4. Projection (or I prefer, Direction): Review your reflections on learning, look ahead, and set goals for the future.

I add a Connection stage, in which you create hypertext links and publish your portfolio to enable feedback from others, which can occur before or after the projection/direction stage.

Multimedia project development usually includes the following steps (Ivers & Barron, 1998):

1. Assess/Decide
2. Plan/Design
3. Develop,
4. Implement
5. Evaluate

Assess/Decide. The focus is on needs assessment of the audience, the presentation goals, and the appropriate tools for the final portfolio presentation.

Design/Plan . In the second stage, focus on organizing or designing the presentation. Determine audience-appropriate content, software, storage medium, and presentation sequence. Construct flow charts and write storyboards.

Develop.   Gather materials to include in the presentation and organize them into a sequence (or use hyperlinks) for the best presentation of the material, using an appropriate multimedia authoring program.

Implement . The developer presents the portfolio to the intended audience.

Evaluate . In this final stage of multimedia development, the focus is on evaluating the presentation's effectiveness in light of its purpose and the assessment context.

Five Stages

I have created a process for developing an electronic portfolio based on the general portfolio and multimedia development processes (Table 1).

Table 1: Stages of Electronic Portfolio Development

Portfolio Development	Stages of Electronic Portfolio Development	*Multimedia Development*
Purpose & Audience	**1. Defining the Portfolio Context & Goals**	*Decide, Assess*
Collect, Interject	**2. The Working Portfolio**	*Design, Plan*
Select, Reflect, Direct	**3. The Reflective Portfolio**	*Develop*
Inspect, Perfect, Connect	**4. The Connected Portfolio**	*Implement, Evaluate*
Respect (Celebrate)	**5. The Presentation Portfolio**	*Present, Publish*

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.

Based on these levels and stages, I offer a few items to consider as you make this software selection.

Stage 1: Defining the Portfolio Context and Goals (**Keywords: Purpose, Audience, Decide, Assess).** What is the assessment context, including the purpose of the portfolio? Is it based on learner outcome goals (which should follow from national, state, or local standards and their associated evaluation rubrics or observable behaviors)? Setting the assessment context frames the rest of the portfolio development process.

What resources are available for electronic portfolio development? What hardware and software do you have and how often do students have access to it? What are the technology skills of the students and teachers? Some possible options are outlined in Tables 3 & 4.

Table 3. Technology skill levels.

1	Limited experience with desktop computers but able to use mouse and menus and run simple programs
2	Level 1 plus proficient with a word processor, basic e-mail, and Internet browsing; can enter data into a predesigned database
3	Level 2 plus able to build a simple hypertext (nonlinear) document with links using a hypermedia program such as HyperStudio or Adobe Acrobat Exchange or an HTML WYSIWYG editor
4	Level 3 plus able to record sounds, scan images, output computer screens to a VCR, and design an original database
5	Level 4 plus multimedia programming or HTML authoring; can also create QuickTime movies live or from tape; able to program a relational database

Table 4. Technology Available

1	No computer
2	Single computer with 16 MB RAM, 500 MB HD, no AV input/output
3	One or two computers with 32 MB RAM, 1+ GB HD, simple AV input (such as QuickCam)
4	Three or four computers, one of which has 64+ MB RAM, 2+GB HD, AV input and output, scanner, VCR, video camera, high-density floppy (such as a Zip drive)
5	Level 4 and CD-ROM recorder, at least two computers with 128+ MB RAM; digital video editing hardware and software. Extra Gb+ storage (such as Jaz drive)

Who is the audience for the portfolio—student, parent, professor, or employer? The primary audience for the portfolio affects the decisions made about the format and storage of the presentation portfolio. Choose a format the audience will most likely have access to (e.g., a home computer, VCR, or the Web).

You will know you are ready for the next stage when you have:

- identified the purpose and primary audience for your portfolio,
- identified the standards or goals you will use to organize your portfolio, and
- selected your development software and completed the first stage using that software.

Stage 2: The Working Portfolio   **(Keywords: Collect, Interject, Design, Plan).** What is the content of portfolio items (determined by the assessment context) and the type of evidence to be collected? This is where the standards become a very important part of the planning process. Knowing which standards or goals you are trying to demonstrate should help determine the types of portfolio artifacts to collect. For example, if the portfolio goal is to demonstrate the standard of clear communication, then examples should reflect student's writing (scanned or imported from a word processing document) and speaking abilities (sound or video clips).

Which software tools are most appropriate for the portfolio context and the resources available? This question is the theme of the rest of this article. The software used to create the electronic portfolio will control, restrict, or enhance the portfolio development process. The electronic portfolio software should match the vision and style of the portfolio developer.

Which storage and presentation medium is most appropriate for the situation (computer hard disk, videotape, LAN, the Web, CD-ROM)? The type of audience for the portfolio will determine this answer. There are also multiple options, depending on the software chosen.

What multimedia materials will you gather to represent a learner's achievement? Once you have answered the questions about portfolio context and content and addressed the limitations on the available equipment and users' skills (both teachers' and students'), you will be able to determine the type of materials you will digitize.

This can include written work, images of 3-D projects, speech recordings, and video clips of performances. You will want to collect artifacts from different time periods to demonstrate growth and learning achieved over time.

You will know you are ready for the next stage when you have:

- collected digital portfolio artifacts that represent your efforts and achievement throughout the course of your learning experiences, and
- used the graphics and layout capability of your chosen software to interject your vision and style into the portfolio artifacts.

Stage 3: The Reflective Portfolio   **(Keywords: Select, Reflect, Direct, Develop)**. How will you select the specific artifacts from the abundance of the working portfolio to demonstrate achieving the portfolio's goals? What are your criteria for selecting artifacts and for judging merit? Having a clear set of rubrics at this stage will help guide portfolio development and evaluation.

How will you record self-reflection on work and achievement of goals? The quality of the learning that results from the portfolio development process may be in direct proportion to the quality of the students' self-reflection on their work. One challenge in this process is to keep these reflections confidential. The personal, private reflections of the learner need to be guarded and not published in a public medium.

How will you record teacher feedback on student work and achievement of goals, when appropriate? Even more critical is the confidential nature of the assessment process. Teachers' feedback should also be kept confidential so that only the student, parents, and other appropriate audiences have access. Security, in the form of password protection to control access, is an important factor when choosing electronic portfolio development software.

How will you record goals for future learning based on the personal reflections and feedback? The primary benefit of a portfolio is to see growth over time, which should inspire goal setting for future learning. It is this process of setting learning goals that turns the portfolio into a powerful tool for long-term growth and development.

You will know you are ready for the next stage when you have:

- selected the artifacts for your formal or presentation portfolio, and
- written reflective statements and identified learning goals.

Stage 4: The Connected Portfolio   **(Keywords: Inspect, Perfect, Connect, Implement, Evaluate)**. How will you organize the digital artifacts? Have you selected software that allows you to create hyperlinks between goals, student work samples, rubrics, and assessment? The choice of software can either restrict or enhance the development process and the quality of the final product. Different software packages each have unique characteristics that can limit or expand the electronic portfolio options.

How will you evaluate the portfolio's effectiveness in light of its purpose and the assessment context? In an environment of continuous improvement, a portfolio should be viewed as an ongoing learning tool, and its effectiveness should be reviewed on a regular basis to be sure it is meeting the goals set.

Depending on portfolio context, how will you use portfolio evidence to make instruction/learning decisions? Whether the portfolio is developed with a young child or a practicing professional, the artifacts collected along with the self-reflection should help guide learning decisions. This process brings together instruction and assessment in the most effective way.

Will you develop a collection of exemplary portfolio artifacts for comparison purposes? Many portfolio development guidebooks recommend collecting model portfolio artifacts that demonstrate achievement of specific standards. This provides the audience with a frame of reference to judge a specific student's work. It also provides concrete examples of good work for students to emulate.

You will know you are ready for the next stage when:

- your documents are converted into a format that allows hyperlinks and you can navigate using them,
- you have inserted the appropriate multimedia artifacts into the document, and
- you are ready to share your portfolio with others.

Stage 5: The Presentation Portfolio (Keywords: Respect, Celebrate, Present, Publish).

How will you record the portfolio to an appropriate presentation and storage medium? These will be different for a working portfolio and a presentation portfolio. I find that the best medium for a working portfolio is videotape, computer hard disk, Zip disk, or network server. The best medium for a formal portfolio is CD-Recordable disc, Web server, or videotape.

How will you or your students present the finished portfolio to an appropriate audience? This will be a very individual strategy, depending on the context. An emerging strategy is student-led conferences, which enable learners to share their portfolios with a targeted audience, whether parents, peers, or potential employers. This is also an opportunity for professionals to share their teaching portfolios with colleagues for meaningful feedback and collaboration in self-assessment.

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 (See Table 5 for a comparison of software. Find detailed descriptions, software resources, comparison information, and selection guidelines throughout the process online at www.iste.org/L&L).

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 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.

TABLE 5

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 at the beginning of the article, 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.

I would be interested in hearing from educators who have used any of these (or other) tools and who would be willing to share their successes or frustrations in a case study. (See the online supplement at www.iste.org/L&L for more on how to participate.)

References

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Danielson, C., & Abrutyn, L. (1997) An introduction to using portfolios in the classroom. Alexandria, VA: Association for Supervision and Curriculum Development.

Ivers, K., & Barron, A. E. (1998) Multimedia projects in education. Englewood, CO: Libraries Unlimited, Inc.

Software Publisher websites

Relational databases

FileMaker Pro (http://www.filemaker.com/products/fm_home.html

Microsoft Access (http://www.microsoft.com/office/access/default.htm

Hypermedia card formats

HyperStudio (http://www.hyperstudio.com/

HyperCard (http://www.apple.com/hypercard/

Digital Chisel (http://www.pierian.com/products/authoring_tools/digital_chisel3/dc3.htm

Asymetrix Toolbook (http://www.asymetrix.com/products/

SuperLink (http://www.alchemediainc.com/

Some commercially available electronic portfolio templates use some of these programs.

Multimedia authoring software

Macromedia Authorware (http://www.macromedia.com/software/authorware/)

Macromedia Director (http://www.macromedia.com/software/director/

Network-compatible hypermedia

HTML Web page editors

Adobe Page Mill (http://www.adobe.com/products/pagemill/main.html

Adobe GoLive (http://www.adobe.com/products/golive/main.html

FileMaker Home Page (http://www.filemaker.com/products/hp_home.html

Macromedia DreamWeaver (http://www.macromedia.com/software/dreamweaver/

Netscape Composer (http://home.netscape.com/communicator/composer/v4.0/

…and many, many more HTML Editors

Adobe Acrobat portable document format (PDF) files (http://www.adobe.com/products/acrobat/main.html

PDF Conversion Programs:
PrintToPDF (http://www.jwwalker.com/pages/pdf.html) (Macintosh only) $20 shareware single user
Win2PDF http://www.daneprairie.com/ (Windows NT or 2000) free for non-commercial use, $35 single user license fee
5D PDF Creator http://www.pdfstore.com/mainpage.asp?webpageid=216&pdfsproductid=1057 (Windows or Mac) $99
PDF Converter http://www.amyuni.com/pdfpd.htm (Windows 3.1/95/98/2000/NT) $129 single user
PDF Driver 4.0 http://www.zeon.com.tw/pdfdrive.htm (Windows 95/98/NT/2000) $12.50 Education Version

Other tool software programs

Integrated "Works" programs, especially those that allow creation of slideshows

AppleWorks (http://www.apple.com/appleworks/

Microsoft PowerPoint (http://www.microsoft.com/office/powerpoint/default.htm)

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Table 5. Portfolio construction tools compared.

	Common Development Tools	Structure and Links	Player available	Advantages	Disadvantages	Ease of Use 1=low skill 2=high skill	Technology Required 1=low tech 2=high tech	Cost (w/ educator discounts)
Relational database	FileMaker Pro	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

Stages of Electronic Portfolio Development

Levels of Portfolio Development (based on level of difficulty)	1 — Defining the Portfolio Context & Goals — 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.	2 — The Working Portfolio — 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.	3 — The Reflective Portfolio — **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).	4 — The Connected Portfolio — **Organize the digital artifacts.** Create **hypermedia links** between goals, artifacts, reflections. **Identify patterns** through the "linking" process.	5 — The Presentation Portfolio — **Record** the portfolio to an appropriate presentation and storage medium. **Share** the portfolio with an appropriate audience.
1 - Text only. 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.	*Development Software:* Any Word Processor	*Development Software:* Any Word Processor	*Development Software:* Any Word Processor	*Development Software:* Microsoft Word (linking to other Word documents) AppleWorks (linking to other Works documents)	*Storage/Publishing Tools:* Zip Disk or Floppy Diskette or Hard Drive or Server
2a - With Graphics. Portfolio data is entered into a structured format, such as a database or HyperStudio template or HyperStudio (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.	*Development Software:* Database PowerPoint or slide show HyperStudio Inspiration (mind mapping software)	*Development Software:* Graphics software Database PowerPoint or slide show HyperStudio Digital still camera	*Development Software:* Database PowerPoint or slide show HyperStudio	*Development Software:* HyperStudio	*Storage/Publishing Tools:* Videotape (digital-to-analog conversion)
2b - With Audio & Video Portfolio incorporates digitized audio and video artifacts linked to the portfolio, and stored on CD-ROM or server.		Audio capturing software Video capturing software (analog-to-digital conversion)	Audio editing software Video editing software		*Storage/Publishing Tools:* CD-ROM
3 - With Navigational links 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.		*Conversion Software:* Adobe PDFWriter or PrintToPDF (Mac only) Acrobat Distiller		*Development/Editing Software:* Adobe Acrobat Exchange	*Storage/Publishing Tools:* CD-ROM
4 - With WWW links 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.		*Development & Publishing Software:* HTML authoring software	*Development & Publishing Software:* HTML authoring software	*Development & Publishing Software:* HTML authoring software PowerPoint*	*Storage/Publishing Tools:* WWW Server
5 - With Interactive Multimedia 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.	*Development & Publishing Software:* Macromedia Director	*Development & Publishing Software:* Macromedia Director	*Development & Publishing Software:* Macromedia Director	*Development & Publishing Software:* Macromedia Director	*Storage/Publishing Tools:* Streaming Server