

Digital Portfolios: A Confluence of Portfolio Assessment and Technology

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Introduction

Two powerful trends in teacher education are rapidly intersecting. The first is the use of performance-based portfolios for assessment, instruction, and professional development. The second involves the transformation of the computer from a complicated instrument of a few zealots to a seamless, universally available tool that facilitates tasks involving the access to and processing of knowledge. This

article briefly summarizes each of these two trends, explores their connections, and poses some possibilities that teacher educators may want to consider as they plan for the future.

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The Trend Toward Performance- Based Assessment and Portfolios

The use of portfolios is becoming commonplace in today's schools and universities. They reflect a trend toward assessments of performance that go "beyond the bubble" of such devices as multiple choice exams. Portfolio assessment is generally

thought to be a more "authentic" way to demonstrate teaching skills and expertise. An amusing story serves to illustrate the point. An American educator who was examining the British educational system asked a headmaster why so little standardized testing took place in British schools. "My dear fellow," he replied, "in Britain we are of the belief that, when a child is hungry, he should be fed, not weighed" (Bowers, 1989). This anecdote points out a weakness in America's traditional reliance on standardized testing to measure student achievement and to sort students like so many beans. The problem with standardized tests is that they do not address the wide range of skills learned in school and needed for functioning effectively in society.

At the federal level, Goals 2000 addresses the need for better assessment with its calls for alternate national assessment techniques that get closer to student learning than standardized, traditional tests. The National Board of Professional Teaching Standards (NBPTS) has defined standards of teaching excellence subject to alternative assessment (Darling-Hammond, 1995). Many states and school districts have adopted alternative assessment strategies. The California Learning Assessment System (CLAS) was an attempt to link curriculum, instruction, and assessment, using performance assessment. While CLAS was dismissed by its home state, several other states have adopted CLAS strategies.

Among alternative means of assessment, performance-based assessment attempts to bring instruction and assessment closer together in an effort to ensure that real world skills are observed, practiced, and mastered. Skills such as speaking, writing, listening, reading, drawing, or performing are assessed by having students produce an observable example or exhibition. Assessment that is related to performance and understanding, and based on classroom instruction, is seen as more authentic than traditional assessments (Perrone, 1991). Grant Wiggins points out that "the proof of a person's capacity is found in their ability to perform or produce, not in their ability to answer on cue" (Bruder, 1993). Howard Gardner expresses this view: "I believe that we should get away altogether from tests and correlations among tests, and look instead at more naturalistic sources of information about how peoples around the world develop skills important to their way of life" (1987, p. 189). He also suggests that "the school seeks to encourage the unique blend of intelligences in each of its students, assessing their development regularly in intelligence-fair ways" (1993, p.75).

Portfolios provide a natural and effective means of "intelligence-fair" performance-based assessment. Portfolio assessment meets the definition of "performance-based" by allowing the learner to display a variety of evidence of performance, such as products or exhibitions. J.A. Arter and V. Spandel (1992) state that a portfolio is a purposeful collection of student work that tells the story of the student's efforts, progress, or achievement in given areas. Such purposeful collections include student participation in selecting the contents of the portfolio, increased ownership in the process by helping to develop guidelines for selection, establishment of criteria for judging merit, and evidence of self-reflection.

Some Examples of Portfolios Assessment

Portfolios have long been in use in the arts; artists, dancers, musicians, and actors all have traditionally developed portfolios of their work which were used as a demonstration of competency in their given field. Both the California New Teacher Project, a pilot project initiated by the California Legislature from 1988-1992, and the Beginning Teacher Support and Assessment (BTSA) program (1992-present) proposed a pattern of apprenticeship, mastery, and renewal. The BTSA project established the use of experienced mentor teachers, with proven skills, to assist new teachers in the first two years on the job. In addition to standardized tests, observation of teaching, and examination of lesson plans, the project also incorporated portfolios as an assessment tool to help new teachers document and reflect on their professional development. (Bartell, 1995; Izu, Long, Stansbury & Tierney, 1995).

In recent years, many teacher education programs have been involved with portfolio assessment both at the level of assessing teacher performance and at the level of helping teachers and schools implement portfolio assessment for K-12 students. A number of universities have used portfolios in preservice programs to increase reflection, provide a record of professional development, and promote dialogue with more experienced teachers. At a growing number of universities, portfolios are integrated into the teacher education program for the purpose of documenting accomplishment of program goals and to demonstrate growth of student performance over time. Jeri A. Carroll, Dennis Porthoff, and Tonya Huber (1996) state that portfolio assessment allows teacher education students to develop philosophy and pedagogy and connect these to program goals, as well as stimulating reflection and reasoning abilities. Through the use of portfolios, students were reported to have been able to tie together all parts of the undergraduate teacher preparatory experience. Portfolio assessment is becoming common practice in teacher education programs across the nation.

Students in teacher education programs that require portfolios also benefit from having the portfolios to prepare for job interviews. When all the students in a program have portfolios they can compare each others' and learn to distinguish varying levels of professional quality. Further, the stress of job interviews can be mitigated by the confidence that accompanies an assemblage of items that reflect the students' best work. Portfolios can also be used as effective props in role playing job interviews. Administrators from local school districts report that portfolios are instrumental in the hiring process. One stated, "When we've interviewed several candidates in a day, the one who stands out is the person who brings a portfolio and shows concrete examples of work" (Seifert, *et. al.*, 1993).

Portfolios typically contain a variety of exhibits. Formative and summative evaluations from supervisors, cooperating teachers and site administrators can provide objective evidence of the development of a student's performance. Formal

letters of recommendation allow the student to cite valuable professional references. Perhaps closest to the heart of the student teacher are realia such as lesson plans, student work samples, photographs, and videotapes of teaching experiences. James Barton (1993) provides a good summary of the strengths that portfolios provide teacher education:

- Empowerment:* The shift of ownership of learning from faculty to student;
- Collaboration:* The ability to allow students to engage in ongoing discussions about content with both peers and teachers;
- Integration:* The ability to make connections between theory and practice;
- Explicitness:* The student's focus on the specificity of purpose for the portfolio;
- Authenticity:* The portfolio provides direct links between artifacts included and classroom practice; and
- Critical thinking:* Provided by the opportunity to reflect on change and growth over a period of time.

Portfolios can motivate students to learn because they have the power to make connections between theory and practice and to select items for the portfolio that express their purpose and design. Portfolios encourage university faculty to learn to collaborate with students. In this new and evolving teacher-student relationship, there can be an on-going renewal of energy for both parties.

Problems and Limitations of Portfolio Assessment

The strengths of portfolios speak for themselves, but there are also such problems as storage, maintenance, access, ownership, and transportation. A common complaint frequently emerges in discussions of portfolios: the amount of space given to storing materials and artifacts is massive. At Florida State University, there is an entire room set aside for the development and use of portfolios. Students there and at other institutions gather artifacts together in a series of notebooks, store them in filing cabinets, or in boxes and crates (Barton, 1993).

A number of problems in addition to storage have been noted. Maintenance problems are frequently reported, such as losing or misplacing items. Access problems include retrieving specific types of exhibition when reviewing many portfolios. What about comparing writing samples of students in comparison groups such as several fifth grade classes? The collection of work samples from a variety of subjects also presents problems of indexing: does the history paper count for writing or history, or both? Transportation problems include hauling bulky projects around and having videocassettes melt in cars left in the sun. Ownership problems involve who actually owns the portfolio's contents. For example, after a student graduates or after an employee leaves the position, who owns and is responsible for the contents of the portfolio? (Grady, 1996; Solomon, 1993; Gellerman, 1994; ES-M School District, 1995).

In some cases portfolios are used in making decisions about teacher certifica-

tion and advancement. Questions have been raised about this practice because of the subjectivity involved in evaluating portfolios, the variability in content, and the lack of consensus on teacher standards (Doolittle, 1994).

Many of these problems associated with portfolio assessment can be addressed through the use of technology. The advent of multimedia, telecommunications tools, and electronic storage media can serve educators at all levels in the design and implementation of digital portfolios. Some background on the development of educational technology in recent years will provide a context for describing some technological solutions to the above problems.

The Trend Toward Technology in Education

The pace of change in the use of technology in education has been so rapid that it is difficult to describe. Consider the technology used a few years ago. Computer hardware was severely limited in terms of memory and speed. Software was relatively crude and often difficult to use. The pioneer educators who obtained Apple II and Radio Shack computers and then struggled to learn operating systems and programming languages were sustained by a vision of the potential of such technology to assist students in the learning process.

The advantages of word processing over typing were obvious. Higher order thinking was promoted by the creative use of such applications as data bases and simulations. Trends toward cooperative learning and student-centered instruction were facilitated by skillfully integrating technology into problem solving lessons. The price for pursuing this vision was that educators were often left to their own resources in a number of the following areas: funding equipment, seeking support for acquiring skills, adapting existing curriculum to a new way of teaching, and meeting frequent frustration at the limitations of the technology and lack of institutional support.

The current state of hardware and software offers applications that are powerful to the learning process and relatively easy to implement. Graphic User Interfaces (GUI) have nearly eliminated the need for learning arcane operating systems or programming languages. Interactive programs involving CD-ROMs, laser disks, and memory intensive hardware offer learners experiences simply unobtainable without technology. The cost of memory, central processing units, monitors, and peripherals has plummeted as fast as speed, efficiency, and ease of use have increased.

The advent of the Internet and its GUI-based browsers and search engines has produced a quantum leap in access to information and potential to enhance learning. HTML (the programming language of the Internet) editors are now available that allow Web pages to be constructed with little or no writing in the programming language. Home pages are popping up in schools and classes at an accelerating pace. The World Wide Web (WWW or Web), the most popular part of the Internet, was

designed to access a large data base easily. Mosaic was the first GUI-based Web browser, invented in 1991. Now inexpensive Web browsers are so common that they are built into some TV sets. The momentum toward Internet use can be appreciated with a few of the following statistics:

- In 1994 Americans spent more money on computers than TV sets;
- In 1995 more computers were sold than TV sets;
- Half of all home computers and nearly all new ones have a modem, allowing Internet access;
- Over 30 percent of American homes have computers;
- A Nielson study showed that Americans spend more time on the Internet than watching rental videotapes;
- The Internet doubles in size every 53 days. (Thornburg, 1997)

This rapidly evolving information technology is revolutionary in regard to processing and accessing information. Educators are well advised to consider the implications of this technological revolution on teaching and learning and on the structure and functioning of educational institutions themselves.

Hypermedia may be seen as a key to understanding these implications. "Hyper" in this case means non-linear, the ability to jump around among learning environments like specialized data bases or MUDs (Multiple User Domains) of persons with like interests. In a traditional learning model, there is a sequence of topics in a series of lectures or readings, perhaps with homework in between. This linear approach has everyone proceed at the same pace, regardless of talent, interest or background knowledge. Evaluation is in the form of a grade that is intended to indicate the retention of the content.

Hypermedia can make this model obsolete by enhancing learning in many ways. It displays more of the context of the learning by means of multiple modalities, thus enriching the opportunities for learners to find more meanings in the material presented. Access to multiple modalities of information also allows learners to construct exhibitions of their learnings that involve text, images, sounds, animations, and videos, as well as primary documents such as on-line interviews with people from around the world and experts in many fields. Hypermedia makes access to multiple modalities more convenient, encouraging truly student-centered learning to occur.

The use of hypermedia in teacher education programs can be expected to increase dramatically in the near future for several reasons. The problem of memory limitations is nearly solved. High capacity servers, removable storage devices and optical storage devices are becoming affordable and widely available. Such advances are facilitating portability, as evidenced by the increased use of inexpensive laptop computers. The access to the Internet is perhaps the most dramatic development in technology, allowing multimedia portfolios to be posted and accessed from any on-line computer.

The Internet also offers unlimited possibilities for interaction among students

and educators world-wide, both currently and in ways that are being rapidly developed. M. Riel (1994) discusses some implications that such technology may have in the future. She foresees "many different communication tools that provide for a new form of exchange" (p. 469) which will create a demand for highly specialized interpersonal skills in the workplace. For example, one skill that will prove necessary in a globally connected workplace is the ability to present oneself to others in distant locations in digital form using interactive multimedia technology.

The Digital Portfolio: At the Confluence

In the above discussion, the trends toward performance-based assessment and toward increased use of technology have been described. A confluence of these trends is occurring in the development of portfolios that are entirely digitized. The strengths of such digital portfolios become apparent when examining some pioneering efforts currently under development.

The Technology Group at the Coalition for Essential Schools, supported by an IBM grant, has over the past several years been investigating ways in which technology could support portfolio assessment. Three questions were formulated to help schools make educational decisions involving portfolio assessment:

- What should a graduate of this school know and be able to do?
- How can a student demonstrate the skills and knowledge that a graduate should have?
- How can a school arrange its systems so that all students can exhibit the desired skills and knowledge? (Niguidula, 1996)

Technology clearly has a large role in answering each of these questions.

In a discussion of technology trends, Elizabeth Gellerman (1994, p. 14) states, portfolio "assessment is greatly assisted by multimedia. Instructors can scan images of student's [sic] written work or art, capture audio of students reading, and include word processing and hypermedia files.... instructors can digitize video of students' performances via computer." Additionally, with the use of technological tools, students achieve a wider audience and support system for their work, as well (Riel, 1994).

Karen Sheingold of Educational Testing Service sees assessment as a social process involving discourse about evidence of accomplishment, using a common language for discussing accomplishments, and developing of shared values and explicit criteria for evaluating student work. She sees technology enhancing assessment in several ways: It makes work in a variety of media accessible, portable, examinable, widely distributable and allows performances to be replayed on demand (Barrett, 1995).

Kim Palmer (1995) cites several examples of classes using interactive software programs to promote performance-based assessment. Interactive software programs are designed to let students work toward their own solution to a problem,

making a number of decisions along the way based on the evidence at hand. This active approach to learning is seen as a trend that allows more development of higher order cognitive skills development, problem solving, and creativity than traditional approaches where one correct answer is sought. C. Holzberg (1994) cites Mill Valley Elementary School in Erie, Pennsylvania, where third graders created multimedia presentations on the human body and then presented them to other classes.

Kevin Bushweller (1995) describes a school in Vermont that discovered several advantages in using digital portfolios. Audio and video recordings of students' reading could be saved from grade to grade, providing a developmental record of reading skills. Digital storage eliminated the problems that were inherent in tapes, such as storing them and of cuing them to the correct spot. In St. Louis, teachers report using digital portfolios to great effect in parent conferences, for example, playing audio excerpts of students reading.

On the other hand, problems emerged with the digital technology. Some files were accidentally or maliciously trashed. Students forgot passwords and lost their files. Computer systems sometimes crashed, causing frustration and lost data. Another problem is the lack of available computers in many schools, which prevents digital portfolios from being more widely used. In Buffalo, a teacher pointed out the biggest obstacle to digital portfolio assessment is lack of technical support for teachers. A RAND study of Vermont's portfolio project found problems with reliability in some areas, but overall saw instruction changing in a positive direction.

Pilar Lemus-Tejeda, *et al.* (1996) in discussing the benefits of digital portfolios in their project at San Jose State University, state the following:

The end result of a truly integrative project demonstrates student reading and writing proficiency in one coherent product. A regular portfolio, however, cannot take advantage of this product.... Most current attempts at integrative activities require videotapes, audiotapes and hard copy of written material. Each component of the project must be saved independently as must each project. When the time comes for the student and teacher to discuss the portfolio, all of the various materials must be gathered with the equipment needed to access them.... (These) problems can easily be solved with electronic portfolios.

The logistics involved in implementing a digital portfolio project have been tested at Eastern High School in Jefferson County, Kentucky. Students were organized into teams to be responsible for creating the portfolio contents. One team of seniors was responsible for developing digital samples of their work. They put written work into word processing files, scanned drawings, and used video and audio recordings of student performances. A second team provided technical support for the first group, learning about hypermedia systems for the construction of digital portfolios. Faculty served as advisors to students about what sorts of demonstration projects would address specific goals and what level of quality was expected (Niguidiula, 1993).

There are some current visionary programs that use cutting edge technology in teacher education programs. Student teachers at the University of California at San Diego use the Internet to plan lessons and develop multimedia projects that involve a variety of learner interactivity (Souviney, 1996). At Michigan State University, electronic portfolios are being implemented in a pilot project. Education students build an electronic portfolio as a WWW home page. This page is accessible to anyone with a browser (Ropp, 1997). The Maryland Assessment Consortium is a statewide staff development project that includes a multimedia data base for teachers and METNET, a statewide on-line system facilitating communication among educators. Such projects indicate the beginnings of a trend toward performance based assessment of teachers via technology.

Considerations About the Future of Digital Portfolios in Teacher Education

From such pioneering efforts as described above, a number of issues emerge. Teacher educators may benefit from considering some possible ways that their profession will be impacted by the confluence of portfolio assessment and technology.

The trend toward increased use of educational technology in teacher education can be expected to continue. Costs of hardware and software will continue to fall while the power of educational technology will continue to rise. Technology literacy among students and teachers will increase, along with an increasing need for technology proficient professionals. Increased federal and state support for educational technology can be expected. An increasing number of classrooms wired for the Internet will enable more use of distance learning and distributed education. It seems likely that performance-based assessment will continue to develop. Portfolio assessment will be refined and become more technology based. The greater presence of technology in schools and improved technology literacy among students and teachers will have a profound impact on education.

In terms of assessment, hypermedia can allow students from all backgrounds to demonstrate their strengths on a common playing field in a more "intelligence-fair" manner than multiple choice tests. Isabelle Bruder (1993) raises a consideration of equity and the expansion of educational assessment using technology. Putting the problem in perspective, he points out that multiple choice tests had the advantage that students from all economic classes could compete against a common standard. Today, technology is more available to richer schools, and to expect sophisticated assessment involving technology of everyone would be unfair to those in technology-poor schools. This is a problem that needs to be addressed as technology moves into schools at an uneven rate.

An example from outside teacher education provides an alternate perspective on the confluence of portfolio assessment and technology. Peter J. Denning (1996) describes a first generation hyperlearning environment at The Center for the New

Engineer at George Mason University. This hyperlearning model allows learners to assess their current levels of knowledge against well-defined standards. Learners can then pace themselves, backtracking if necessary, in visiting a number of multimedia stations on suggested paths that teach specific topics or skills. Students may attempt trial certifications of a standard at any time. Evaluation is not a grade, but a certificate of competence based on time on task, the path followed, and standards met. This model is currently housed in a physical room with a teacher present, but variations of this model could be adapted for implementation on the WWW. Teacher educators can gain insights for their own programs about using information technology to structure content and assess skills from such visionary efforts.

With the implementation of any revolutionary form of technology comes not only the excitement of attempting to realize its potential benefits, but the recognition of its potential dangers. The benefits and dangers have distinct ramifications that need careful consideration by teacher educators planning to implement digital portfolios. For example, the more information that is disseminated on the Web, the more misinformation also appears. A key challenge to all educators will be teaching information processing skills that allow the individual to determine the validity and usefulness of information. Perceived threats of automating the teaching process need to be addressed by developing ways to keep a human face on technology-rich instructional and assessment strategies. If digital portfolios are going to be increasingly posted on the Web, ethical and aesthetic issues arise. Complex questions of content, privacy, security and taste need to be considered.

Conclusion

From the above discussion, it is apparent that teacher educators will be facing a wide variety of challenges arising from the confluence of performance-based assessment and digital technology. Teacher educators must make a determined effort to see that digital technology enhances teacher preparation and practitioner effectiveness. Performance-based assessment has the distinct advantage of combining instruction and assessment. The authors recommend that we as teacher educators help our students identify instructional and assessment techniques in which they are successful and seek ways to have technology strengthen these successful experiences.

An insight reported from the Thayer High School project in Winchester, New Hampshire, is worth contemplating: "The most important thing in the adoption and adaptation of a new technological tool is the culture of the school. A school that is willing to change will find the possibilities in the new tool; a school that is reluctant to change will find the burdens" (Niguidula, 1996, [on-line]). Building on this insight, we must help new teachers "find the possibilities" of the confluence of technology and performance-based assessment in the form of digital portfolios.

Existing digital portfolio projects (see below) can be valuable resources as we

plan for the future. Above all, we need to remain current so that we can model effective strategies for integrating new technologies into instruction and assessment.

Annotated Digital Portfolio Projects

- <http://www.comm.vt.edu/faculty/blakely/portfolio.html>: includes examples from student teaching, educational background, projects implemented.
- <http://funnelweb.utcc.utk.edu/~gillespe/portfolio/port/port.htm>: portrait of a teacher, teaching philosophy, activities.
- <http://scnc.wmston.k12.mi.us/~jnagy/>: a basic page.
- http://edweb.sdsu.edu/edweb_folder/people/DKipperman/DKipperman.html: includes invitation to join a www project.
- <http://204.123.13.30/funky/teaching.htm>: includes pictures of classroom teaching.
- <http://www.kckps.k12.ks.us/coronado/kelley.html>: includes links to schools and projects
- <http://www.li.net/~zen/kelly/portfolio.htm>: includes unit and lesson plans
- <http://www.sirius.com/~darkboat/portfolio.html>: includes samples of students' work
- <http://www.callutheran.edu/~llong/math01.html>: includes project math: an interactive guide to mathematics education.
- <http://www.callutheran.edu/~rapkine/Leslie.html/webbie.html>: includes lesson plans
- <http://www.ovhs.opusd.k12.ca.us/StaffPages/MDeBaun/mdebaun.html>: includes funding resources and school reform information, as well as links to the school page developed by this teacher: <http://www.ovhs.opusd.k12.ca.us/>

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