By Abigail Garthwait and Jim Verrill

E-Portfolios:
Documenting Student Progress

Digitally capturing students' growth throughout the year provides opportunities to assess learning and a whole lot more.

Electronic portfolios (e-portfolios)—digital collections of student work—are flexible, motivating, and extremely useful teacher tools that can address a range of needs from student assessment and professional development to creating connections between teachers, students, and parents.

With guiding support from school administration and a media specialist, we conducted an invigorating e-portfolio project with third-grade students. Initially, the e-portfolios were intended for use primarily as a tool to assess students' science learning in such topics as sound, inertia, ecosystems, and health. By the end of the year, e-portfolios had become a vital interdisciplinary part of the classroom and school. In addition to presenting students' progress over the course of the year, e-portfolios allowed students to share their progress with classmates and parents in student-led "teacher conferences," and we all—the classroom teacher, students, and school colleagues—used e-portfolios as an opportunity to develop new technology skills in various ways.

While this article focuses on how e-portfolios were developed using the resources available at one school, similar portfolio projects—even nonelectronic versions—can be conducted under different circumstances, so teachers with varying levels of available resources can experience the benefits of using portfolios.

Works in Progress

A primary purpose of any type of portfolio assessment is to teach students how to evaluate their own work via

application of quality standards and personal goals. With e-portfolios, the main idea is to keep students focused on learning rather than on individual projects or products—e-portfolios are *part* of the learning process, not a result of it.

In our case, the teacher had explored e-portfolios through professional development coursework, and he was eager to try such a project with his students. He knew he wanted to use e-portfolios to demonstrate his students' understandings in science and to incorporate student-led conferences as part of the portfolio project. He also wanted to include students in the process of creating the portfolios in as many ways as possible.

For these reasons, he decided the e-portfolio project would include *working portfolios* to use during the conferences and a CD-ROM showcase of students' "best work" to wrap up the year.

A working portfolio is not simply a collection of pieces of student work or "artifacts." Instead, teachers use working portfolios to involve students in continuous assessment, self-reflection, goal setting, choosing, comparing, and contrasting. In a working portfolio, it's necessary that artifacts demonstrate students' learning growth over time.

Our e-portfolio project took place at a small elementary school with a computer lab of 22 Macintosh computers and a school server. In addition, the third-grade classroom contained three computers, as well as a scanner, digital camera, and CD burner.

Word-processed material is a traditional component of portfolios and our project was no exception. With guidance from the teacher, students selected several items to save as part of their portfolios including:

- A polar food web from an ecosystem unit;
- A report on motion;

- An article each student wrote for the class's science newspaper;
- A movie based on Newton's laws of motion; and
- An egg drop experiment report.

For other items that may be included in an e-portfolio, see the box on page 26.

Student Participation

Students played a large role in the e-portfolio project, acting as partners with their teacher in the assessment process. In fact, the e-portfolios were as much a "working ground" as an exhibition gallery.

At the beginning of the school year, the students were taught how to save their work on the school server. This simple procedure "systematized" the collection of student data, greatly reduced the chance of lost work, and placed more responsibility on the student. The process quickly became second nature as students logged onto the server, opened their personal folder, and saved items such as reports, digital pictures, and movies.

Students were also responsible for identifying works-in-progress and those that needed improvement. Through "hyperlinking"—digitally connecting early work to later work—students actively participated in the e-portfolio assessment, adding written reflections that showed how understanding changed over the course of the year.

To help students learn how to evaluate their artifacts, the teacher provided guidance for articulating growth and areas of improvement; opportunities for students to review work as a group; and rubrics for students to self-assess projects.

If students or the teacher identified any areas for improvement, the teacher then developed a mini lesson for small groups to address the topic; if the whole class had a common need, the teacher taught a whole-class lesson. The teacher also held verbal brainstorming sessions called "Think Alouds" with the whole class. These sessions helped students make connections between their schoolwork and personal experiences and were useful in teaching students how to assess their own work.

Pride in Achievement

About a month before the end-of-year student-led conferences were scheduled, the class began reviewing works and reflecting on growth throughout the year. Because their files had been saved on the school server, students could access them from the classroom, computer lab, or library, and the teacher could review the portfolios from his home.

As the parent conferences approached, the teacher realized that the students needed practice in oral communication. First, he asked them to do a verbal self-analysis of the pieces they judged "excellent." Next,

students practiced sharing those pieces with their peers; in this way learners could be taught to support each other's progress by focusing on the positive points and offering a constructive critique. This process eased their fears of the conference itself, but also helped develop self-reliance and analytical skills such as being able to assess a "failed" experiment, which may be more insightful than a successful one. Reflection helped solidify their learning.

Parents or guardians were scheduled in groups of three for blocks of one and a half hours. The day before students prepared the room by displaying recent work and setting up stations: three chairs facing each computer. The e-portfolios would serve as the focal point for each student-led parent conference.

On conference day, students were both excited and anxious about leading their own conferences. When parents entered the classroom, they received a list of questions adapted from Pierce-Picciotto's *Student-Led Parent Conference* (1996) to spur discussion and were led to a computer station by their child. Some questions specifically targeted common science misconceptions, such as the notion that objects with different masses fall at different rates or that no forces are acting on the object if it's at rest.

The teacher joined each student-parent conversation at least three times during each 45–90 minute conference. During those visits, the teacher answered questions and encouraged deeper reflections from the students. Even when responding to a parent query, the teacher would redirect the question to the student, emphasizing student ownership and leadership of the process.

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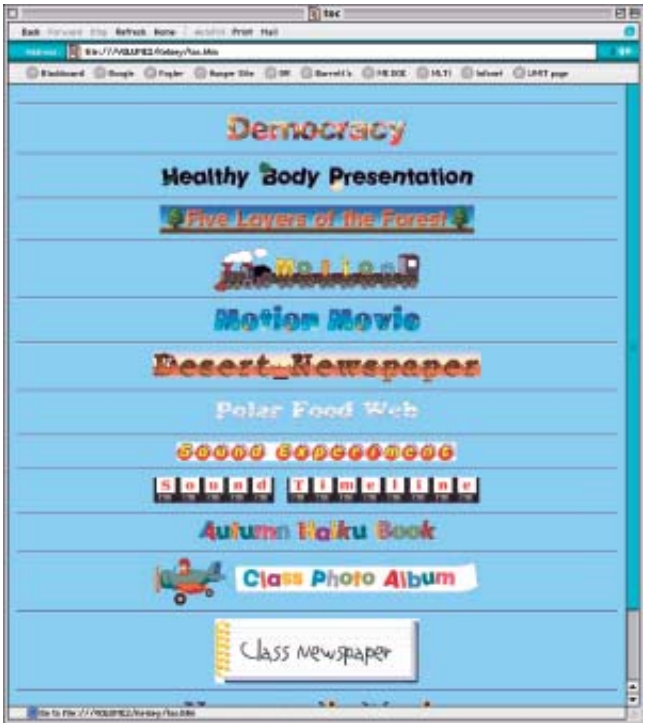
Students glowed with pride as they displayed their work and talked about the strengths and weaknesses of each of their chosen projects. Parents listened intently and asked probing questions: What characteristic protected the eggs from being damaged when dropped? How do you access the school server? What makes a link work in your HyperStudio stack?

From the observation of students at the conferences, it was obvious to the teacher that technology had a tremendous impact on student learning and communication of student achievement. And parents were enthusiastic and amazed at the information they learned from their children!

For parents, the e-portfolios *showed* what their children knew more explicitly than simply stating facts or reducing knowledge to a percentage grade. The visuals included in the e-portfolios emphasized a diversity of science much beyond the stereotypical laboratory coats and test tubes, and parents observed their children developing useful and significant technological skills.

Figure 1.

E-portfolio table of contents.



Digitizing Project Success

After the conferences, the teacher turned his thoughts to producing the "best work" exhibition CD-ROM to document the project. (Grant funding had made it possible for each student to take home a CD-ROM of their e-portfolio for 50 cents.)

To create the CD-ROM, the teacher chose an html editor program to create the basic structure because of its adaptability. (The majority of the parents in his classroom owned PC-compatible computers, while the school used Macs. Since any family with access to an Internet browser—at home or in a public library—could easily view the files, platform differences weren't

Suggested Artifacts for an E-Portfolio

- Science biography written by the student
- Student's overview of entire portfolio
- Student-written activity descriptions that place the activity within a larger context (For example, a digital photograph of an egg-dropping container and a description of the challenge given to the class, along with a summary of the reasons for the selection or rejection of potential building materials)
- Excerpts from laboratory manuals
- Complete learning logs that capture process skills (for example, learning how to analyze food consumption via spreadsheet graphs)
- Rubrics and student's "error analysis"
- Teacher commentary on student work
- Voiceover explanations (such as how to focus a telescope)
- Running list of student's inquiries or problems that they've posed
- Standardized test scores
- Peer interviews regarding long-term investigations
- Links to Internet webpages

For the more technologically advanced:

- Screen shots of spreadsheets (for example, summarizing data from a lab experiment) or databases (for example, organizing the physical attributes for a leaf collection project)
- QuickTime video of scientific role playing
- Data dumps from pdas (personal digital assistants) collected during field trips or from science probes
- Student- or teacher-created computer simulations
- Pdfs (portable digital format files) from a desktop publishing project

an issue.) An html editor program also allowed for multiple media formats to be displayed with an Internet browser, such as *Microsoft Internet Explorer* or *Netscape Navigator*, both free for educational use.

Each CD included guidelines for using the e-portfolio as well as how to install all the necessary plug-ins (QuickTime and HyperStudio) included on the disk. With a little extra technical effort, the students learned how to change their index pages by updating links to newly selected material. For example, students made diagrams of each ecosystem that they studied. They could now select the scanned drawing with the most details or the one that best demonstrated classification systems.

The teacher intended to perform the "grunt work" himself, so he made a simple template that linked the table of contents to each product. Though it was easy to place students' electronic work into this template, digitizing work that hadn't originated on the computer was more time-consuming than he anticipated.

A solution revealed itself while the teacher observed students during learning center time. He noticed two girls working diligently at a computer, so he asked if they'd like to scan in some photographs. Did they ever! They quickly grasped the operations and soon shared it with the next duo of students who came to look over their shoulders. "Of course, involve the students in the process!" Next year, student help will be incorporated from the start—and more artifacts will be created electronically!

Pleasant Surprises

The e-portfolio project produced numerous unanticipated benefits for the class and the teacher. E-portfolios made it possible to provide multiple copies of class projects, which would be time- and cost-prohibitive if produced in hard copy. In the autumn, the class collaboratively made a book about the seasons. Each page featured a student's haiku containing a seasonal scientific fact and a torn-paper illustration. Usually, such a book might remain in the classroom or be presented to the school library media center. This year, the poetry received wider distribution because each page was scanned and became a portfolio component for all students.

Looking beyond print, e-portfolios are perfectly suited for multiple media formats. Students included QuickTime files (made with *iMovie*) that demonstrated their understanding of Newton's laws of motion. In another unit, students were assigned a take-home project on sound: Each student had to create a device that made a specified sound on demand. One invention involved using a window screen—an object not many teachers would be willing to store indefi-

Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

Assessment Standard A:
Assessments must be consistent with the decisions they are designed to inform.

- Assessments are deliberately designed.
- Assessments have explicitly stated purposes.
- Assessment procedures are internally consistent.

nitely! A recording of the sound creation and a digital photograph immortalized the creation.

Changes and Improvement

Although the e-portfolio project was very successful, there were several ideas for improvement. Thinking about the next iteration of e-portfolios, the teacher planned to include an extra provision for individually chosen work that best demonstrated personal growth. He also planned to make learning "more visible" in the e-portfolio.

For example, next year, during a unit on digestion and nutrition, the teacher planned to have students use software to create "mind maps" or webs that captured their existing knowledge in blue circles, adding their own inquiry questions in red squares.

Using such a method, the teacher could then quickly access all webs on the school server to ascertain whether students harbored misconceptions or scientifically erroneous views. At the same time, he might note intriguing questions and adapt instruction to suit the learners' needs and interests. At the end of the unit, students could review the webs and correct misunderstandings, adding new understandings in green circles. This creates a window through which the learning process could be captured through an e-portfolio.

Another change to the e-portfolio project would be to make the *National Science Education Standards* (NRC 1996) more visible within the portfolio itself, by incorporating key components in standards-based learning—such as rubrics, checklists, and other assessment tools—as part of the e-portfolio.

In the first e-portfolio project, students and parents had used the vocabulary, criteria, and indicators in discussing student work only during the student-led parent conferences. Parents appreciated having descriptors of performance levels to guide them and students could refer to the assessment tools for reflection in answering parent questions. Next time, however, these assessment tools will be part of the e-portfolios and not just present during the unit or in conferences.

True evidence of the project's success came in an e-mail from a father who lived hundreds of kilometers away from his child. When his son came to visit that summer, along came his digital portfolio. The father described how thrilling it was to view his son's work in depth; the e-portfolio served as a focal point for communicating science knowledge.

Yes, the e-portfolios were a time-consuming endeavor, but the rewards were well worth the efforts of teacher, students, and parents. Throughout the e-portfolio project, students remained highly motivated and took educational risks not seen in previous third-grade students. They covered topics in greater depth and worked hard at reflecting and articulating progress, achievement, and areas in need of improvement. Technology facilitated authentically applying their knowledge *as* they were learning.

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Resources

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