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ABSTRACT

This document presents the 3 2002 issues of the newsletter "NewsWire," (volume 5). Issue Number One focuses on collaborative Web projects. This issue begins with descriptions of four individual projects: "iEARN"; "Operation RubyThroat"; "Follow the Polar Huskies!"; and "Log in Your Animal Roadkill!" Features that follow include: "Bringing the Global Grocery List Project Work to the Classroom"; "International School Partnerships through Technology"; "What it Takes to Develop or Participate in a Collaborative Web Project"; "Sources for Collaborative Web Projects"; and "Adult Literacy Students Explore Antarctica Virtually." Issue Number Two deals with handheld technologies, and features include: "The Impact of Technology on Education"; "Handheld Technology: The Basics"; "An Overview of Wireless Networking"; "Considerations When Buying a Handheld"; "Educational Advantages"; "Educational Concerns"; "Student Teachers and High School Seniors Beam the Internet"; "101 Great Educational Uses for Your Handheld Computer"; "Picture This!"; "Using Handheld Technologies in Schools"; and "Using eBooks on Handhelds." Also included in this issue are a sampling of projects; grant opportunities; sample educational software; handheld resources; and a glossary. Features of issue Number Three, which focuses on evaluating the impact of technology, include: "Tips for Writing an Evaluation Plan for a Technology Grant"; "Evaluation Questions--Guiding Inquiry in Schools"; "Lessons Learned from Action Research: Evaluation from the Trenches"; "Alabama Indicators for Measuring Progress"; "State Guidelines for Enhancing Education Through Technology (EETT) Projects"; "TAGLIT: A Tool for Measuring a Project's Results"; "Steps in Evaluating a School or District Technology Program"; "Thinking Beyond Surveys"; "Resources for Evaluation: An Annotated Bibliography"; and "Tools for Evaluating Technology Projects and

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Edited by
Elizabeth Byrom, Margaret Bingham, Gloria Bowman, & Dan Shoemaker

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SouthEast Initiatives Regional Technology in Education Consortium

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SEIR*TEC News-Wire

SouthEast Initiatives Regional Technology in Education Consortium

Volume Five ◆ Number One ◆ 2002

THIS ISSUE:

Collaborative Web Projects

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SERVE
Improving Learning through Research & Development

Collaborative Web Projects Abound

No question about it! The Internet is rich in resources for the classroom, and one of the most beneficial resources for students is the collaborative Web project. These online projects range from very structured activities, in which students share collected data, to full units of study correlated to state or local standards and designed by the participants.

During the 2001–2002 school year, collaborative Web projects were a means of making international connections. President George Bush and Secretary of Education Rod Paige highlighted "Friendship Through Education," a consortium of groups brought together by iEARN (International Education and Research Network) to facilitate expanded links between students from the United States and students in countries with Muslim populations. The **www.friendshipthrougheducation.org** website links students through letters, e-mails, collaborations, and exchanges to build an understanding between nations and to help each learn more about the other.

According to the Friendship Through Education website, their projects include the following:

- **Comfort Quilts Project:** Students, ages 5–18, make quilts using fabric squares on which they have drawn smiley faces, to share with other children who need comforting. The project was created in response to the needs of children receiving medical, hospital, or clinic care; experiencing the devastating effects of natural disasters; and in transition, crisis, or displacement from their homes.
- **Kids Share Hope:** The kids of the Global Schoolhouse collaborate by sharing their messages of hope, support, and condolences in response to the September 11, 2001 "Attack on America" tragedy. Students submit scanned drawings and digital photos that portray a feeling of hope and support. These messages and images are compiled and shared with school children directly impacted by this disastrous act of terrorism.
- **Global Art:** Students, primarily ages 5–12, create and exchange artwork and writing with several other participating schools on the theme, 'A Sense of Caring,' respond to one another's artwork/writing through e-mail conversations, and display the Sense of Caring Artwork with descriptive writing and e-mail messages from participating schools/classes/organizations in a Global Art Show at their schools.

Whether the collaborative online project has an international

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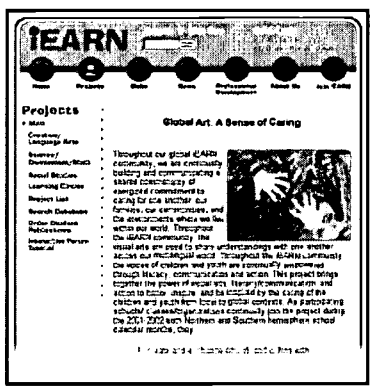
theme or a narrow curricular focus, teachers and students join with others to share data or ideas, draw conclusions, or develop a product. Through these projects, the world becomes smaller, the classroom becomes multi-dimensional, and learning becomes authentic.

If you have not had your class participate in a collaborative online project, now is the time to begin. The articles in this issue of *NewsWire* address several projects to join, sites to check for project listings, tips on developing and participating in online projects, and experiences others have had in developing or managing collaborative online projects. Perhaps they will be just the sparks you need to get started! ◆

iEARN: Offering Projects Since 1988

Recognized as one of the first groups to offer students and teachers opportunities for online collaborative projects, iEARN (International Educational and Research Network) at **www.iearn.org** has an extensive list of online projects. All iEARN projects focus on providing the following:

- ◆ An inclusive and culturally diverse community
- ◆ A safe and structured environment in which students can communicate
- ◆ An opportunity to apply knowledge in service-learning projects
- ◆ A community of educators and learners making a difference as part of the educational process



The projects are organized in three major curricular groups:

- ◆ Creative/Language Arts
- ◆ Science/Environment/Math
- ◆ Social Studies

Participants have the option of participating in structured online projects that are ready to start (See **www.iearn.org/projects/index.html**) or to work with other classrooms to design and implement projects specific to a curricular area or classroom need.

In addition to online projects, iEARN provides interactive forums, news, professional development opportunities, and an extensive database of members and projects.

Membership in iEARN is school-based. Once a school joins iEARN, all teachers and students in that school have access to all network resources. (2001–2002 school-year prices were $100/teacher or $280/school.)

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Operation RubyThroat: The Hummingbird Project

A classroom teacher commented, "Hummingbirds are wonderful tools to excite students about learning." This idea is the basic premise of "Operation RubyThroat: The Hummingbird Project," an innovative, international, cross-disciplinary initiative through which students, teachers, and others collaborate to study the behavior and distribution of Ruby-Throated Hummingbirds (*Archilochus colubris*).

The project is an outreach endeavor of the Hilton Pond Center for Piedmont Natural History, a 501(c)(3) non-profit education and research site near York, South Carolina.

Since its founding in 1982, the Hilton Pond Center has been the most productive bird-banding station in the Carolinas and one of the most active in the southeastern United States. It is also a popular field trip location for K–12 students, education interns, teachers, college classes, conservation groups, garden clubs, and civic organizations from across the Southeast and beyond. The extensive education and research work of the Center is described in words and photos at **www.hiltonpond.org**.

Bill Hilton, Jr., founder and executive director of the Center, is the facility's primary research scientist. He is licensed by the federal Bird Banding Laboratory to capture wild birds, place bands on their legs, and release them unharmed.

"Banding is one of the most important tools in helping us learn about bird migration," Hilton said, "and about other things we wouldn't know about birds, including longevity, site fidelity, and population dynamics. But bird banding is also a useful educational tool, and nothing I've ever done with students excites them more than catching a bird, banding it, and releasing it back into the wild. Learners of all ages can benefit from banding hummingbirds, and I see working with these tiny feathered creatures as the ultimate bird-banding experience."

It was this dual interest in bird banding and hummingbirds that gave Hilton the idea for "Operation RubyThroat: The Hummingbird Project," a unique initiative that challenges and connects student observers through the Internet. In Operation RubyThroat, participants observe the Ruby-Throated Hummingbird in their home countries and share information with peers across North and Central America. Students make observations on such hummingbird behaviors as early arrival dates during spring migration, numbers of visits to hummingbird feeders, and species of native and cultivated flowers that are visited by hummingbirds. Data are submitted electronically via online forms to the Hilton Pond Center, which then assists participants in disseminating write-ups of their work through scientific and education publications and/or the Operation RubyThroat website at

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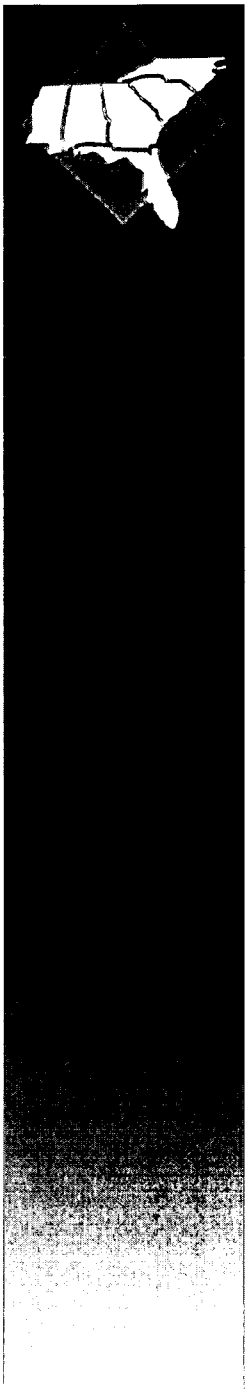

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www.rubythroat.org. Participants learn about natural history; reinforce skills in math, science, writing, geography, art, language, and other disciplines; and gain a deeper understanding of the need for environmental cooperation among people of the Americas.

In March 2002, Operation RubyThroat affiliated with The GLOBE Program (www.globe.gov), an online project that allows students at GLOBE-certified schools to submit hummingbird data and correlate them with traditional GLOBE observations of atmosphere/climate, hydrology, soils, land cover, and phenology. Non-GLOBE schools may follow the same hummingbird observation protocols outlined for GLOBE and submit data directly to Operation RubyThroat via data@rubythroat.org.

Because hummingbirds tolerate humans and are drawn to feeders and flower gardens, these tiny birds are ideal subjects for observation and research. In addition, the general mystique of hummingbirds makes them a stimulating topic for study and discussion among children and adults of all ages. Operation RubyThroat capitalizes on such interest to raise awareness in its participants of natural history and of the interconnectedness—and mutual conservation needs—of countries in the Western Hemisphere.

In Year One (2001–2002 academic year), participants in Operation RubyThroat were located in the United States, primarily in the Carolinas and New York. In Year Two, the project will expand to include participants in 38 states and Washington D.C., and in Year Three to Canada, Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama—everywhere Ruby-Throated Hummingbirds regularly occur.

Although many teacher/student groups are using Operation RubyThroat to enhance science learning, Hilton is quick to point out that this is "not just a science project." Operation RubyThroat is, by design, a cross-curricular project that encourages teachers to incorporate science into other disciplines and vice versa. For example, when a science class studies hummingbird migration, students also learn about geography. Or, when science students generate graphs showing how many times a hummingbird visits a feeder in a day, students master math and computer skills. And when an art teacher has students observe hummingbirds and make sketches, her students will learn about hummingbird morphology, as will drama students who write and perform a play based on hummingbird behavior. In keeping with current trends in education, Operation RubyThroat activities are correlated with Howard Gardner's theory of "Multiple Intelligences."

One of the most compelling aspects of Operation RubyThroat principles is that they can be used with students at any grade level. Students in elementary school might learn to make simple observations about hummingbirds, while advanced high school biology students might conduct hummingbird research projects that are worthy of publication. Teachers who field-tested Operation RubyThroat in the 2000–2001 academic year reported that project principles excite students about science, yield demonstrable improvement in science learning, and "align with state and local curriculum standards."

The main goals of Operation RubyThroat are the following "Seven E's":

- Enhance K–12 learning in science, particularly conservation and natural history
- Expand student use of technology, especially in the natural sciences
- Excite students about field research and potential careers in ecology and related areas
- Emphasize integration of natural science learning into all science disciplines, as well as into arts and humanities
- Enlighten students about environmental factors that affect hummingbirds (and humans)
- Encourage international understanding by using technology to

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build student and teacher networks in the Western Hemisphere

- Establish an exemplary program that serves as a model for other cross-disciplinary projects that focus on new topics

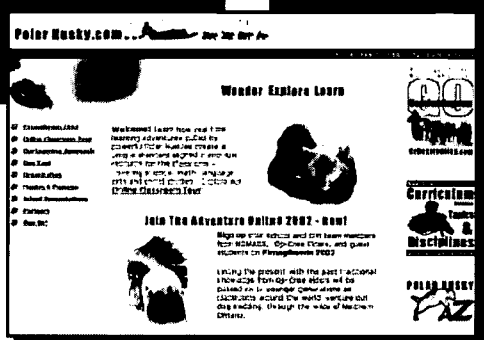
Operation RubyThroat also leads to local conservation efforts through which students and teachers protect or create schoolyard or backyard habitats used by hummingbirds and other organisms.

Hilton Pond Center has received more than $80,000 in grants, corporate donations, and individual gifts to begin implementing Operation RubyThroat. Donors include The Christensen Fund ($35,000), National Fish & Wildlife Foundation and Phillips Petroleum Bird Conservation Fund ($17,500 each), Foundation for the Carolinas Impact Fund ($6,000), and Perky-Pet Corporation ($2,000). These funds will be used in Year One primarily to recruit teacher/student groups from the Carolinas and New York, but participants from any state or country in which Ruby-throated Hummingbirds occur are welcome.

Operation RubyThroat™
The Hummingbird Project

Details about how to join this exciting Internet-based learning initiative are outlined on the Operation RubyThroat website at **www.rubythroat.org**. Teachers also may contact Hilton Pond Center via e-mail at **info@rubythroat.org** for more information. ◆

Follow the Polar Huskies!



For several years, "snow dogs" have been seen in many classrooms around the United States. This is because of the NOMADS Adventure & Education Online Classroom Expeditions.

NOMADS Adventure & Education (**www.polarhusky.com**) has combined adventure with classroom education since 1992, when founders Paul Pregont and Mille Porsild worked with world-renowned explorer and educator Will Steger as part of the highly acclaimed International Arctic Project (1991–1995) on a project that brought global awareness to the importance of Arctic Regions. The first "reports" from the trail consisted of less than ten words, sent from a 2-by-4-foot computer powered by a hand-cranked generator! NOMADS Adventure & Education, Inc. was legally incorporated in 1996 to make the adventures available to more schools.

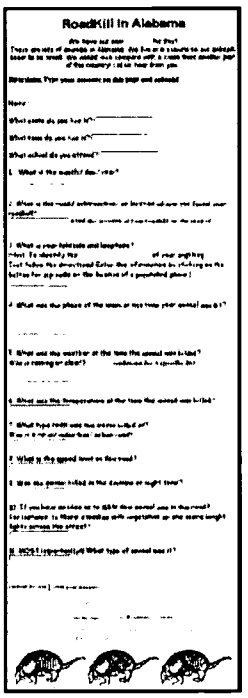
The spring 2002 six-week Pimagihowin (translated "Living From the Land") expedition began February 15, 2002. The expedition explored the wilderness and traveled ancient Native Ojib-Cree paths of northern Ontario by dogsled with powerful polar huskies, as well as by canoe and on foot. The journey was filled with unique scientific and cultural learning opportunities.

The NOMADS project offers an interactive website and a "gated" Web community with a regular collaboration forum, moderated chats, digital labs, video and audio broadcasts from the trail, and an extensive resource database. Comprehensive classroom materials and online resources correlated to U.S. National Education Standards are prepared and sent to each school participating in the expedition. Units within the Curriculum and Activity Guides are designed as multidisciplinary, hands-on, mind-engaging activities that relate to multiple intelligences and learning styles.

Up to 3,000 classrooms may subscribe to each seasonal Polar Husky adventure for $99 each; the cost for an entire school is $299. If you are seeking a collaborative Web project that is structured in accordance with different learning levels for K–12, then check out **www.polarhusky.com** for the next seasonal project!

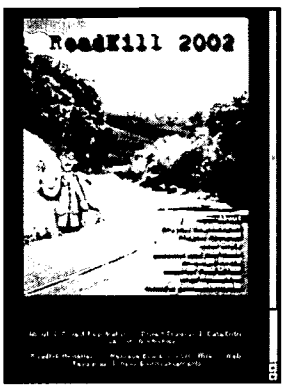
Log In Your Alabama Roadkill!

Teachers in the Mountain Brook City Schools (Mountain Brook, AL) are looking for Alabama Roadkill! As part of their summer Annual Technology Academy, Mountain Brook City Schools (MBCS) participants develop technology-enriched units that correlate with the local curriculum framework. The participants are expected to create and maintain their web pages. One of the projects, Roadkill, is a good example of a collaborative Web project. Even though it is included in the sixth grade listing, author Pam Baugh indicates that the project is appropriate for any age. However, anyone who has worked with middle-school students will recognize that this project will be an instant hit for grades 6–8!



The MBCS project is organized into two major sections: Questions and Performance Tasks/Projects. It uses the same goal as a national RoadKill Project: to involve students and teachers with scientific monitoring of an environmental parameter, accomplished by using the Internet to record findings and compare the findings with those of other schools participating in the project.

The MBCS Roadkill site includes a Warmup-Roadkill in Alabama worksheet and a RoadKill Data Form. On the Warmup worksheet, students complete the KWL chart—What we Know/What we Want to know/What we Learned and make predictions about which animals they might find and under what conditions. On the RoadKill Data Form at **www.mtnbrook.k12.al.us/academy/6thgrade/roadkill/InteractiveRKill.html** students enter their roadkill information and respond to questions about the conditions (weather, lunar phase, and temperature) and location (longitude, latitude, and type of road) that affect animals killed on Alabama roads. Using this form, students submit their data to the MBCS Roadkill web collection. They also can submit their findings to a national project, Roadkill 2001, at **www.edutel.org/roadkill/alt_index.html**. In addition to submitting their findings to the Web, students graph their findings based on the data from the RoadKill Data Form.



Note: The national Roadkill Project began with a National Science Foundation grant called Environet, awarded to Simmons College in Boston, but the project has been moved from the Simmons server (still listed on many sites as the link to the Roadkill Project) to the EduTel Communications, Inc. server at **www.edutel.org/roadkill/alt_index.html**.

If you search the web, you will find several spin-offs or customizations. For instance, a great example of a "make it fit your area" version is the Pennsylvania site at **www.eh.beth.k12.pa.us/monagacci/details.html**. Take a look at the MBCS Roadkill project and consider creating a similar project for your locale. Our other five SEIR◆TEC states—Georgia, North Carolina, Mississippi, South Carolina, and Florida—are also rich in roadkill! ◆

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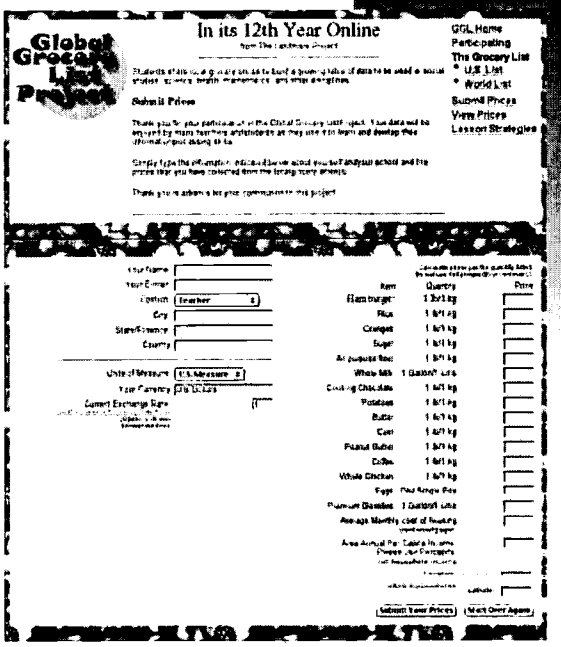
Bringing the Global Grocery List Project Work to the Classroom

By David Warlick

Note: One of the longest-running online projects is the Global Grocery List, developed by David Warlick, who has agreed to describe his experience in posting and managing a collaborative Web project since 1987. We hope you enjoy his recollections of a project that now draws participation nationally and reaches international classrooms.

Students share local grocery prices to build a growing table of data to be used in social studies, science, health, mathematics, and other disciplines.

Project-based learning is a difficult concept to describe because it is a nearly impossible thing to define. There are probably as many different definitions of instructional projects as there are instructional projects. Some are very broad in focus, and others are narrow. Some projects apply to a specific instructional standard, while others integrate a large number of skills and content together. Some projects require telecommunications, and others can be done the old fashioned way—with books. Some projects are complex in implementation; others simple. The Global Grocery List project is the simple type.



Begun in 1987 as an e-mail project, Global Grocery List (GGL) is the second-oldest continuing online project on the Internet. The project started in Person County, North Carolina, where I was the Director of Technology and first asked the question, "How much do groceries cost in your town?" That question was sent out to locations from Miller, Australia, to Dublin, Ireland, and points between over the FrEdMail network. At that time, Person County Schools ran one of the 37 North Carolina nodes to the network, and when the e-mail message went out with a grocery list and the task, students in towns and cities around half of the globe went to their grocery stores, collected prices, averaged the prices when they returned to their classrooms, and sent their prices, via e-mail, back to me. Teachers who sent in price lists were added to a mailing list and received a copy of all prices submitted from that point on.

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Typically, teachers would keep a posterboard chart attached to the wall in their classrooms. As new price lists would arrive in their e-mail boxes, they would have students record the new location and its prices on the chart. Some teachers also kept databases of prices using the original AppleWorks, on Apple II computers. The growing table of prices could then be used throughout the year to demonstrate concepts of social studies (transportation), science (climate), or mathematics (projecting trends or converting foreign currency). In the first year, a health teacher in Montana had his students calculate the best place to get Vitamin C or Vitamin A.

After learning a little HTML and moving to the North Carolina State Department of Public Instruction, I transferred the Global Grocery List project to the Web. It was a static webpage that included an explanation of the project and the grocery list. It also included all incoming prices, which was a giant improvement since any teacher with access to the Web had access to all submitted prices.

In 1996, after I left the Department of Public Instruction and set up office as a consultant, I began to learn how to program webpages to run off a database. The first project to benefit from this new technique was Global Grocery List. Instead of sending their prices to me by e-mail, after which I had to enter them by hand into a webpage, teachers could load a Web form and enter their prices directly onto a webpage. The prices were then added to a database (originally FileMaker Pro and now MySQL) where they could be accessed and printed on price-report webpages at any time.

Today, GGL will accept prices based on metric or empirical units, in any currency listed on the OANDA currency exchange site, and automatically convert prices to a common value. You can access prices in any currency for any year between 1995 and 2002 and list any of the commodities in the price list. The prices can be listed in tables for printing or as a tab-delimited file that can be imported into a spreadsheet.

Recently, teachers have begun making their own GGL websites. Here are a few:

- A lesson description by Ms. Mindy Hensen of Cedar Valley Middle School, posted on the Text Center for Educational Technology website: **www.tcet.unt.edu**
- Ms. K. Johnson, of Oakridge Elementary School, added a GGL page to her classroom website: **www.teacherweb.com/FL/OakridgeElementary/KimJohnson/h1.stm**
- Ms. Throop, of Bascomb Elementary School, also added a GGL page to her classroom website: **http://webtech.kennesaw.edu/sthroop/default.htm**
- Ms. Cindy Best, of Whitney Young Elementary School, added a GGL page as a lesson plan for her students: **www.jefferson.k12.ky.us/Schools/Elementary/Young/ggl.html**

There are two weaknesses of this project as it exists currently. I frequently receive e-mail messages from teachers asking about price lists that are obviously not accurate. Actually, this can be used as a benefit to the instructional process. Students need to see that data from the real world is not always as clean as data provided by textbooks. If the students have to make judgments on whether to use an entry where sugar is selling for $40 a pound, then this is probably a good lesson for them.

Secondly, participation from countries outside the United States is disappointing. Although many schools in Europe and Australia are online and rapidly increasing numbers are using the Net in Asia and parts of Africa, it is still difficult to get project announcements out to these audiences. There must be a trick to it that I will learn in the future.

Until then, there is plenty to learn about the United States from our shopping carts. Check out **http://landmarks4schools.org/ggl/index.html** and join an ongoing collaborative Web project that offers many lesson opportunities for your classroom! ◆

International School Partnerships through Technology

By Diane Midness

I just bubble with excitement for this project and the future of this project. I do not want to contain my enthusiasm. I am like the proud parents or grandparents that say, "Let me show you a picture of...." Except, I say, "Let me show you this e-mail or this project or tell you this story."

My students come to class and ask, "Are we going to work on the project today? Did we get any mail? What do you think is going on there? Did you see ... and ... about their area on the news? When are you going to show us how to do ... and ... so we can do that with our partners? Why did you say they aren't able to write right now?"

These daily questions reaffirm what I feel. They keep the fire burning, and I do not want it to go out for them, for future students, or for myself. This project has been a wonderful way to make my curriculum more relevant, to teach cultural diversity, to teach appropriate social skills or workplace readiness (the fact that they may be working with someone from a different culture or race), and that living in a remote area doesn't mean that you are cut off from the world and the world's events.

—Thelma Kastl, Vocational Education Teacher,
Ashe County High School, North Carolina

Who would not want to have this situation in their classroom? Thelma Kastl and her students have been participating in International School Partnerships through Technology (ISPT) with a class in Ramat HaSharon, Israel, since the fall of 1997. She and other teachers in North Carolina and 40 different countries have learned that working and learning with others from different countries and cultures is motivating for students while making them more aware of the world around them.

The challenges of emerging technologies and a global interdependent economy require students to develop skills in technology, language, and communication. To function effectively, they must understand and respect other cultures, be able to communicate with those who are culturally different, and understand events in other countries and their impact on the United States. ISPT is a program of The University of North Carolina's Center for International Understanding with the objective of preparing students to compete in today's global economy by improving student competencies in technology and cross-cultural communication. Teachers and students use telecommunications to interact directly with and learn from teachers and students in other countries.

Begun in the spring of 1997 with two pilot partnerships, ISPT has sponsored approximately 240 classroom partnerships involving about 7,000 North Carolina students in partnerships with schools in 40 different countries. Approximately 25 North Carolina high school classrooms each semester are partnered with classrooms abroad. Schools in rural areas with little or no exposure to other international cultures are the primary focus.

Teachers from all curricular areas collaborate with international partners to design programs that support their mutual curricular goals. Students implement these programs using Internet technology. ISPT has been particularly popular and successful with

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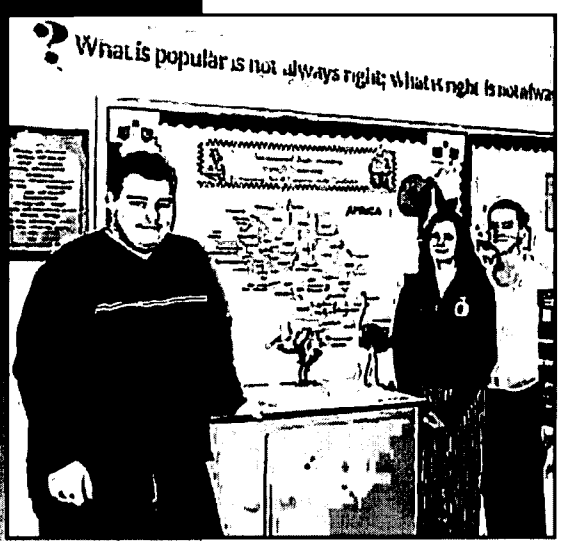
second languages, social studies, and business education teachers. The partnerships provide these students with real applications with real people for achieving curricular objectives. Their experiences in the program enable students to practice language skills, to learn about other cultures, to learn how to communicate with other cultures, and to understand how they are connected with the rest of the world.

The program has defined six cultural communication competencies that students need to develop to communicate successfully in our global society. These include factual knowledge of countries, the ability to recognize similarities and differences in cultures, the ability to recognize the importance of culture in communication, the ability to recognize stereotypes and biases, understanding of the human impact of world events, and the ability to respect cultural differences without agreeing with them. These competencies have been correlated with all high school curricular areas in the North Carolina Standard Course of Study.



Candi Lavender of Parkland High School has found that her partnership has helped students associate what they are learning in World History with real people and real places. Lavender says, "My students learned a great deal about their partnership country that would never have occurred without the partnership: Moldova isn't on the list of countries to cover in World History, but by using Moldova as a case study for the collapse of the Soviet Union and aftermath, students felt they had a stake in what happens there.

"Relevance is so important to teaching social studies to adolescents, and we are not in a vacuum—we are a global community. Teachers would not be able to do this program without the resources and expertise that the ISPT offers."

Mary Alice Lodico of Tuscola High School has moved the communication between students from e-mail to face-to-face conversations. In the fall of 1999, teachers and students from Nantes, France, visited their partner school in Haywood County, and in the spring of 2000, students and teachers from Waynesville went to visit their partners in France.

"Before the French students came to live in the homes of their 'correspondents,' writing e-mails was seen by some students as simply an assignment to be fulfilled for a grade, and I had to nudge them to send their next e-mail," Lodico notes. "Most, however, looked forward to writing and were impatient for replies. Now I don't, and can't, keep track of their exchanges, it happens so regularly.... Communication has taken off, with lots of *Franglais*, but they're developing linguistically and forming terrific bonds that will become fast friendships after a week's stay in the homes in Nantes."

The use of technology is essential for students in ISPT since all communication is done electronically through Internet applications. Students and teachers are given a real application to use the skills they have been required to learn for the North Carolina Computer/Technology Standard Course of Study. Partnerships are given webpages they may develop for communication and publication of student work.

Following the events of September 11, 2001, it is more critical than ever that we strive to reduce conflicts and increase understanding worldwide through international education and collaboration. Teachers and students realize that they do not know as much as they should about cultures other than their own and have begun to wonder what people outside of the U.S. think about the U.S. and its people. Students in ISPT partnerships have

Teresa Wile's keyboarding students at West Bladen High School created PowerPoint presentations based on correspondence with their partners in Hungary and research they did on the Internet. She writes that her students "...have learned to make group decisions, take leadership roles, peer teach, meet deadlines, and develop technology skills."

Stephanie Flatt of John A. Holmes High School writes, "I am really impressed with the responsibility and initiative my students showed in this project. The detail and maturity of the reflections showed their enjoyment, growth, and learning."

Mary W. Evans, a business education teacher at South Lenoir High School, also writes, "This is a wonderful supplement to the curriculum that gives real-world experiences to students that will last a lifetime."

Thelma Kastl recognizes changed student attitudes: "I have seen this partnership turn many of my students from being self-centered to more balanced. It has also allowed my students who are less vocal and social to participate in a project that allowed them to communicate and express ideas without fear."

One of Kastl's students, who originally did not see the need to communicate with anyone outside his community, now says, "I found the project to be interesting and personally fulfilling. It has really changed my life. It changes the way you think about global events happening when you know someone who is personally involved. I hope to meet more interesting people, such as I have in this project, during the rest of my life."

developed an interest in learning more so they can develop greater understanding for themselves and their partners.

A student from Freedom High School working in a partnership with a class in Lebanon wrote, "This partnership has changed how I think about the ways that students in other countries think about America."

Teachers and students have recognized that their relationships with their partners and the new attitudes they are developing will continue to affect their lives after the partnerships are completed.

James Douglas, a business education teacher at Smithfield-Selma High School wrote, "Thanks for making this possible. It has been good for me as a teacher and, I think, for my students. As a matter of fact, I think that my students will benefit for years to come because of my involvement this semester."

ISPT partnerships have not only changed how North Carolina students relate to the world—students from other countries have also had their horizons broadened. Students in India wrote, "We were overwhelmed to receive your letter. All of us are guessing your probable face and figure. The places you all must live must be common for you, but it is a dream place for us. We were all crowding here before your letter...."

A student from China wrote the following to the ISPT coordinator:

> *Thank you so much to join us together in the Internet over the globe. I just want to represent my*

(continued on next page)

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classmates to say: your work means much to us! ...A few months ago our English teacher told us we'll join the ISPT project. Every one of us can't help but be excited.... It's really like a dream, a wonderful dream to us. Now the dream comes true; now we can talk with other youths all over the world; now we can feel and join our friends' lives, no matter how far we are away from them.... Please believe in us, we'll make full use of the priceless chance to communicate over the culture, to know the real world by our hearts, to let the world know: there is an Internet line, which not only connect all youth, but also join the wishes of the future!

More information about ISPT may be found at **www.ga.unc.edu**. The International School Partnerships through Technology Program (ISPTP) is a model that other states may want to consider. Contact Diane Midness of the North Carolina Center for International Understanding (412 N. Wilmington Street, Raleigh, NC 27601, 919-733-4902, **(dmidness@ga.unc.edu)** to discuss the structure and benefits of the ISPT Project.

What It Takes to Develop or Participate in a Collaborative Web Project

Just as the Internet offers multiple sites to join collaborative Web projects, Web travelers can also locate sites with suggestions for both designing online projects and for successfully participating in an existing project.

NickNacks Telecollaborate! at **http://telecollaborate.net** offers not only guidelines for designing an online project but also provides a template for assessing your software and hardware capability for telecollaboration (*NickNacks TeleCheck*), a template of the elements of a successful collaborative project (*NickNacks Project Planner*), tips on exchanging files on the Internet and finding participants, and a list of websites offering existing projects (**http://telecollaborate.net/education/edfind2.html**). One of the strengths of this site is the list of considerations in managing collaborative online projects. These considerations include the following:

1. Know your specific hardware and software needs.
2. Work out the bugs ahead of time.
3. Test your project on a different computer before soliciting participants.
4. Clearly state specifics in your call for participants.
5. Select enough participants to complete project goals.
6. Determine how to handle too many participants.
7. Make sure participants can do what the project requires before the project starts.
8. Practice data exchange procedures.
9. Meet the deadlines you set.
10. Remind participants about deadlines.
11. Encourage and support participants.
12. Be flexible to the needs of participants.

13. Be prepared to go the extra mile.
14. Complete the project regardless of complications or surprises.
15. Thank everyone.
16. Distribute outcomes to all.
17. Keep in touch.
18. Have fun.

(Source: http://telecollaborate.net/education/eddevelop.html)

One of the first sets of guidelines for developing and organizing online projects was from Judi Harris in a 1995 *The Computing Teacher* magazine column, "Mining the Internet," and later in the ISTE publication, *Virtual Architecture* (c. 1998). Some of her ideas on organizing telecollaborative projects can be found in the archived article at http://lrs.ed.uiuc.edu/mining/February95-TCT.html. She suggests:

1. Choose the curricular goals.
2. Choose the activity's structure.
3. Explore examples of other online projects.
4. Determine the details of your project.
5. Invite telecollaborators.
6. Form the telecollaborative group from those interested or registered.
7. Communicate regularly with participants.
8. Create closure.

Maybe developing an online collaborative project is more than you want to try just now. Instead, start with participating in several of the many projects on the Web. When deciding to participate, follow the steps below based on the iEARN (International Education and Research Network) guidelines:

1. Identify a project of interest and find out if the project is still active.
2. Check the "Purpose" and any "Update" topics to correlate them with your classroom needs.
3. Contact the project coordinator to introduce yourself, your class/school, and reasons for your interest in the particular project.
4. Locate the necessary equipment, software, and materials.
5. Develop a classroom timeline for conducting the project activities.
6. Organize the students for the activities and in groups for peer editing of messages prior to submitting.
7. Respond to recent postings/topics on the forum. Remember, all students want and need responses to their messages.
8. Communicate. Even if you can't contribute for weeks, send a note to say so.

Whether you decide to develop a collaborative Web project or just participate in some of the existing projects, have fun! ◆

Check Them Out: Sources for Collaborative Web Projects

OnlineClass at **www.onlineclass.com** offers Collaborative Online Projects: six-to-ten interactive learning units in which schools (grades 2–9) work in collaborative groups. Units such as Dinosaurs Alive, Bugs Count, The North American Quilt, On the Trail with Lewis and Clark, We're Talking Books, DoodleOpolis, Blue Ice, and Mythos include a collaborative activity, activities for the classroom, Web reading, Web links, moderated Web discussion, student work displays, and teacher support. Pricing for units begins at $135/school. Also available is a free monthly e-mail newsletter containing tips on how to use the Internet in the classroom, technology reports, updates on OnlineClass programs, and comments from educators using the Internet in the classroom.

The Quest Channel from Classroom Connect at **http://quest.classroom.com** offers standards-driven, interactive geographic expeditions and travel with a team of experts, adventurers, and students to solve mysteries around the world. Team leader, Dan Buettner, is a familiar figure to long-time Internet-using educators from his early adventures in MayaQuest and AfricaQuest. Past quests and resources are available when you subscribe to the current quest. Most past expeditions have targeted upper elementary through high school students.

The Stevens Institute of Technology offers collaborative K–12 science projects at **http://k12science.ati.stevens-tech.edu/collabprojs.html**. The projects, correlated with the National Science Education Standards, are designed and managed by the Center for Improved Engineering and Science Education (CIESE), located at the Stevens Institute of Technology. These free projects primarily focus on middle school science curriculum but include projects in math, science, and educational technology for grades 1–12. Each project has a similar structure with a project description, project instructions, project data, student area, teacher area, reference material, and online help. The projects are correlated with the National Science Education Standards.

Global SchoolNet Foundation is the "tried and true" source for online collaborative projects. They have offered free collaborative learning activities since 1984. Located at **www.globalschoolnet.org**, the site's Projects Registry is a clearinghouse of projects from around the globe, some hosted by the Global SchoolNet Foundation and others by reputable organizations and by classroom teachers worldwide. Users can search by student age, project start dates, curriculum, technology, or level. Also available are online, real-time expeditions for students to join a sailing ship, climb a Peruvian Andes peak, or travel around Africa or Australia.

The Project Center at **www.eduplace.com/projects** from Houghton Mifflin Company is filled with collaborative Internet K–12 classroom projects submitted by educators for mathematics, science, social studies, and reading/language arts classrooms. The Project Center also includes a guide for creating your own online project and a form for submitting the project for posting. There is no charge for participating either in an existing project or for submitting your own project for others to join.

Some sites with links to other website collections of collaborative online projects include the following:

- Kentucky Educational Television: **www.ket.org/Education/IN/projects.html**
- Judy Harris's book: **http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture** (click on Curriculum-based Telecommunicating Projects & Resources)

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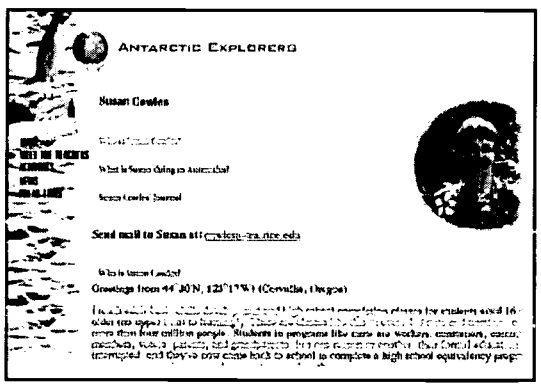
Adult Literacy Students Explore Antarctica Virtually

Adult basic education and ESL learners in Elizabethtown, North Carolina, have been writing to and learning from an adult literacy teacher in Antarctica. Leigh Thompson, Director of the Bladen County Literacy Council and a teacher in the program, is participating with her adult learners in a NSF-sponsored electronic fieldtrip to learn about Antarctica and the research that is being done there. They are looking at maps, reading about Antarctica, thinking about what it would be like to be there, and having answers to their questions come back from Antarctica.

Susan Cowles is an adult educator from Corvallis, Oregon, spending two months on a scientific research expedition studying Persistent Organic Pollutants (POPs) at Palmer Station, Antarctica. Every day or two, she posts a new journal entry and pictures to the expedition's website at **http://tea.rice.edu/tea_cowlesfrontpage.html** and encourages adult learners to e-mail her. Thompson reports that the learners have been particularly interested in the terrain, living conditions, her daily activities, and whether she has been homesick.

Tanisha, a new reader, wanted to ask about who else lives at the site and where they get food and clothing, but like many adult learners, she was hesitant to type her questions into an e-mail, perhaps because of a lack of confidence in writing skills as well as technophobia. Thompson offered to type from dictation, and the message was sent. A day or so later, Tanisha was ecstatic to find a personal response to her questions and then eagerly typed additional questions herself.

"One of the best things about our participation in this project," says Thompson, "is that it gives the students an opportunity to learn about the Internet and about e-mail by actually getting to send mail to someone who is very far away, who is interested in their questions, and who sends a reply almost immediately." ◆



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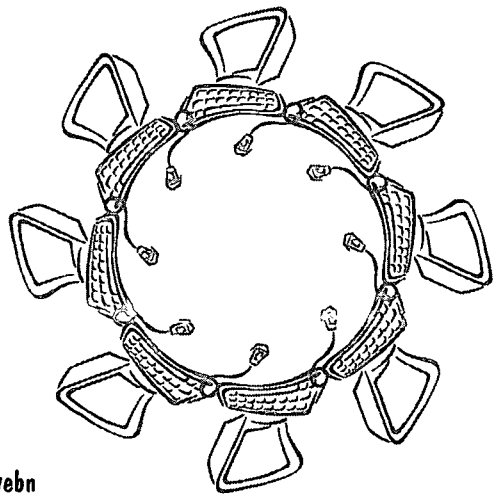

- The NJ NIE Project: http://k12science.ati.stevens-tech.edu/training/findingprojects.html
- The Math Forum/Drexel University: http://mathforum.org/workshops/sum96/data.collections/datalibrary/lesson.ideas.html
- Computer Pals Across the World site from the University of Central Florida: http://reach.ucf.edu/~cpaw
- Eisenhower National Clearinghouse: www.enc.org/weblinks/classroom/projects
- Blue Web'n: www.kn.pacbell.com/wired/bluewebn
- Interactive projects for K–12 from Youth Net: www.youth.net/welcome.html#K-12

Electronic mailing list archives, such as EDTECH (www2.h-net.msu.edu/~edweb) or WWWEDU, often advertise other online collaborative opportunities, as well as those sponsored by professional organizations such as the National Council of Teachers of Mathematics (www.nctm.org). Nearly any class or school project can be turned into an online collaboration with a website, e-mail, and a little imagination. So, check out the sites above, not only for participation, but also for ideas about how to turn your favorite project into a collaborative online project! ◆

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SEIR◆TEC NewsWire

SouthEast Initiatives Regional Technology in Education Consortium

Volume Five ◆ Number Two ◆ 2002

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SERVE
Improving Learning through Research & Development

Using Handheld Technologies in Schools

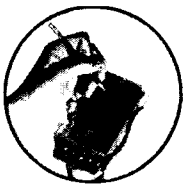
Is a computer for every student—a laptop or even a ratio of one desktop computer per student—still a dream for most schools? Across the Southeast, the response would be a resounding, "Yes!" Several schools, however, are testing handheld computers, such as Palm's Palm Pilots and Hewlett Packard's Jornadas, as possible technologies to provide each student. Many high school students already own a graphing calculator that costs about the same amount as many of these handheld devices. So why provide a student a handheld computer? In addition to being a graphing calculator, a handheld computer can serve as a time-management tool, a graphic organizer, a word processor, a web browser, an e-mail device, and much more.

Originally marketed as a personal organizer for on-the-go business executives and ardent technophiles, personal digital assistants (PDAs) have evolved into handheld computing devices and have become one of the most ubiquitous electronic devices in both the consumer and business worlds. Sometimes known as PDAs, palmtops, pocket PCs, personal PCs, handheld devices, or handheld computers, these devices were described in the *Chicago Tribune* as looking like a "cross between a cell phone and a Nintendo Game Boy."

Due to lower costs, increased functionality, and the availability of new software designed specifically for education, K–12 schools are beginning to take a serious look at handheld computing for teaching and learning, administrative tasks, and communication and collaboration. In fact, the potential for using handhelds in education is almost limitless. Now is the time to begin discovering whether or not these

computing devices can be used to help fulfill the promise of educational computing. They just may be the answer to overcoming the problem of access to technology and to creating equity of use in the classroom. This issue of the **SEIR◆TEC NewsWire** is devoted to exploring the possibilities of handheld computing in K–12 schools. ◆

The Impact of Technology on Education



Although it is difficult to generalize findings from technology research, there should be little question that technology has an important role to play in education. Ask any teacher who really uses technology effectively in the classroom. Ask students who use technology as a tool in their own learning. They'll confirm what the research (Valdez et al., 2000) says:

- Technology makes learning more interactive, more enjoyable, and more customizable. It improves students' attitudes toward content and their interest in learning.
- Technology offers opportunities for learner-control, increased motivation, and connections to the real world.
- Technology can improve student achievement—as indicated by increases in standardized text scores—when it is used to support instruction in the classroom.
- Technology can help students investigate and answer complex questions, develop thinking skills, and learn to access, sort, evaluate, and synthesize information.
- Technology can help students set goals, form and test hypotheses, and make discoveries on their own—helping them develop skills they will encounter in life after school.
- Technology offers tools to share knowledge and learn cooperatively instead of individually.
- Technology can make students more efficient and organized.
- Technology can help students clarify their questions, locate potential answers, and decide on validity, appropriateness, and perspective.
- Technology can be a powerful tool for assembling, modifying, assessing, and studying information; manipulating data; and generating new knowledge and deep understanding.
- Technology enables learners to communicate in new ways with their peers, with experts, and with others around the corner and around the world.

Many studies, however, have shown technology has *not* had a great impact on teaching and learning. Why not? There may be many reasons, but lack of access to technology seems to be among the top culprits. In a study conducted by Elliot Soloway and the Hi-Ce project at the University of Michigan, 50% of the 6,000 respondents (teachers) to a survey reported that their students use computers less than 15 minutes a week (Soloway et al., 2000). Why? Sixty percent of the 6,000 respondents reported that they had one or no computer in their classrooms. Neither they nor their students have access to computers for any extended period of time. According to Soloway and his colleagues, "It's unreasonable to expect computers to have a positive impact on learning and teaching [when students and teachers] have limited access to them and thus aren't using them" (Soloway et al., 2001).

While every student cannot be provided with a $1,000 desktop computer, it is not outside the realm of possibility to imagine a time when every student can be provided with his or her own $100 personal handheld computing device. These affordable devices could overcome the access barrier that is limiting the impact of technology on teaching and learning. Time will tell the story. ◆

References:

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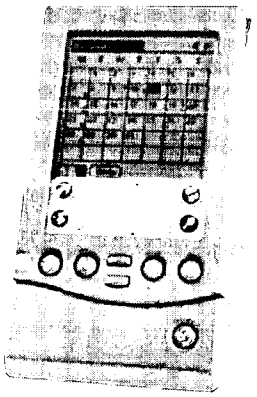
Handheld Technology: The Basics



What is a Handheld Computer?

Handheld computers include those devices originally referred to as personal digital assistants (PDAs) and others that have evolved from that concept. These devices now offer many more computing functions than the original PDAs, which mainly included calendars, address books, and "to do" lists. These devices range in size from those that fit into one hand and use a stylus for input to those with keyboards that are approximately ½ to ⅓ the size of a typical laptop. The term *palmtop* is occasionally used—referring to the natural progression from desktop to laptop to palmtop—however, *palmtop* can be confused with the brand name Palm™, so now the more popular term for these devices is *handheld computer* or *handheld device.*

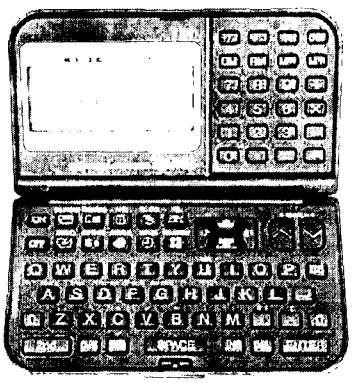
How They Evolved

Apple Computer, Inc. developed the Apple Newton™ in 1993. The company introduced it as the first PDA and sold it as the ultimate information appliance. John Sculley, former chairman of Apple, predicted PDAs would become ubiquitous tools that would hold telephone numbers, keep calendars, store notes, and send and receive data wirelessly. Unfortunately, the Newton was ahead of its time and did not find a market large enough to survive.

In 1996, Palm, Inc. delivered the first truly successful handheld computer, the Palm Pilot. This device helped people organize their lives by providing instant, anytime access to schedules, important phone numbers, addresses, "to do" lists, and other key information. The business world quickly embraced the small and powerful Palm handhelds.

Because of the popularity of the Palm Pilot, several other manufacturers began releasing their own PDA devices. These devices utilized a new operating system from Microsoft called Windows CE, which was basically a scaled-back version of the Windows desktop environment. The most recent version of Windows CE is now called Pocket PC.

Most of the producers of PDA-type devices are trying to encourage the public to think of these devices not as PDAs but as handheld computers. Many producers are not only adding on computer-type capabilities but also combining their devices with other electronics, such as wireless phones, cameras, and probes.



How They Work

Operating Systems—While there are many handheld manufacturers in the market these days, there are really only two major operating systems in direct competition at the time of this publication: the Palm OS, (used by Palm, Handspring, and Sony manufacturers to name a few) and Windows CE/Pocket PC (used by Hewlett Packard, Compaq, Casio, NEC, Toshiba, etc.). In general, the Palm OS represents a more basic approach, and the devices are cheaper. The Windows CE/Pocket PC system is more robust, and the devices are generally more expensive and, due to their more complex system, require more technical support. Currently, handheld devices using the Palm OS have approximately 75% of the market share; however, there are advantages and disadvantages to both operating systems, and the decision to use one or the other depends upon users' needs. Other handheld operating systems being used today include Symbian, used in

(continued next page)

Expansion and Peripherals: Adding On

The original handheld devices were most often used exclusively as personal data assistants (PDAs) to hold telephone numbers and addresses, keep calendars, and store notes. Manufacturers began to realize the benefits of adding peripherals to increase the functionality and desirability of the simple PDAs. Below is a listing of some of the devices available for handheld computers.

- **Portable keyboards:**
  - Palm OS compatible resources
    - www.palm.com
    - www.targus.com
    - www.seiko.com
    - www.landware.com
    - www.fellowes.com
    - www.ibizcorp.com
  - Windows CE compatible resources
    - www.landware.com
    - www.ibizcorp.com
    - www.hp.com
    - www.targus.com
- **Digital camera attachments:**
  - Palm OS compatible resources
    - www.eyemodule.com
    - www.kodak.com
    - www.sonystyle.com/micros/clie
    - www.targus.com
  - Windows CE compatible resources
    - www.casio.com
    - www.nexian.com
- **Optical accessories (barcode scanners):**
  - Palm OS compatible resources
    - www.symbol.com
  - Windows CE compatible resources
    - www.socketcom.com
- **Wireless telecommunications accessories (modems and devices):**
  - Palm OS compatible resources
    - www.palmgear.com
    - www.novatelwireless.com
    - www.synchroscan.com
    - www.red-m.com
    - www1.sprintpcs.com
    - www.handspring.com
  - Windows CE compatible resources
    - www.pretec.com
    - www.novatelwireless.com
    - www.targus.com
- **Accessory to connect handheld to digital projector or VGA display:**
  - Palm OS and Windows CE compatible
    - www.margi.com

cellular phone technology; RIM, used in the BlackBerry™ line of handheld devices; and the Psion EPOC system.

Input—There are a number of options for entering data into a handheld, depending on the model:

- *Onscreen keyboard*—The user punches letters and numbers on an onscreen representation of a standard keyboard.
- *Character recognition program*—The user "handwrites" data using the stylus (e.g., Graffiti for Palm OS and Character Recognizer for Windows CE/Pocket PC).
- *Synchronizing*—Since handhelds don't have floppy drives to transfer data and programs, they must be "synched" with a desktop/notebook computer. This is done with a program installed on both devices (HotSync for Palm OS and ActiveSync for Windows CE/Pocket PC) and a connection between the devices. Depending on the model, this can be done using a cradle, a cable connection, or wirelessly. During synching, schedule and address book information, e-mails, and other specified data are shared between the devices. Synching is also used to install new software on a handheld device.
- *Memory-stick*—The latest models of the Palm OS technology allow data to be shared through memory sticks. These postage-stamp-size memory modules can be easily inserted into the handheld unit for access to pre-recorded applications and data or used to store additional data as one would with a floppy disk or CD-ROM.
- *Infrared port*—Most handhelds have an infrared port that allows users to "beam" or wirelessly transfer programs and data between handheld devices. The infrared port is considered by many to be a major advantage in educational use. This process requires a fairly close proximity between the devices and a clear line of sight.
- *External keyboard*—There are many models that attach to handhelds to allow full-size typing capabilities.
- *Other peripherals*—Data can also be input with probes, modems, network cards, cameras, and many other add-on peripherals.

Output—There are also many ways to output data from handhelds:

- *Screen*—Screens are the most common output method for handhelds, and they vary widely in size, resolution, and readability.
- *Infrared port*—See *Input* above.
- *Synchronizing*—Data can be sent from the handheld back to desktop computers for further manipulation.
- *Peripherals*—Data can be output to peripherals, such as memory sticks, modems, network cards, and printers. ◆

An Overview of Wireless Networking

One of the advantages of handheld technologies is their mobility. However, in order to be truly "mobile," it is important to think about Internet access, and this leads us into the world of wireless communications.

In general, *wireless* is a term used to refer to network-type communications that take place without physical connections (wires), but there are many types of wireless access.

One type of wireless is cellular, which is the same technology that is used with mobile phones. This type of wireless communication is typically used to facilitate long distance communications, such as phone calls. Examples of this type of wireless use include mobile phones, pagers, BlackBerry™ devices, and Internet access via a handheld, such as a Palm or Handspring device. This type of service typically incurs a monthly service fee, which can range from $20 a month and up, depending on the nature of the service. Handhelds that use this technology include Palm's i705 handheld, Handspring's Treo communicator, and various other devices and add-on modules that have wireless modems.

Another type of wireless can be used to facilitate localized communications. Typically, this type of wireless allows a device, such as a computer, to connect to a LAN without a cable connection. An important thing to note about this technology is that it goes through walls and up and down stairs, so there aren't the line of sight issues that exist with infrared technology.

There are three main varieties of this technology:

Bluetooth™—Bluetooth is a wireless solution with a 30-meter radius range. Bluetooth works well for hard cable replacement, and, therefore, printing is likely to be the most important Bluetooth application. Bluetooth supports Ethernet, but because of its slow speed, it is not a typical use. Bluetooth supports voice, and this flexibility is likely to yield some popular applications that relate to automated phone switching between cellular and land-line service. Bluetooth is also likely to be the technology used to enable cashless vending machines and other purchases through cell phones or other Bluetooth-enabled devices. There are new Bluetooth cards available for Palm handhelds, and some of the early applications for these are geared toward document collaboration.

802.11b (also known as Wi-Fi or wireless Ethernet)—802.11b is a protocol used for wireless networking. It is great for locations like older school buildings that are difficult (or expensive) to wire. The range for this technology is typically 150–300 meters in radius and supports up to 11 megabit data rates, which is very fast for Internet access and other applications. This is the technology that Apple is using for its AirPort system, which is very popular with schools. Xircom (a division of Intel) makes Wi-Fi modules for a variety of handhelds. Some Pocket PC handhelds come with Wi-Fi capability built-in.

Home RF—This is a wireless networking protocol similar to 802.11b that is compatible with Ethernet but is considerably slower at 2 megabit. One advantage of Home RF is that it is designed to carry voice data. However, it is waning in popularity and is not currently compatible with Macintosh computers.

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There are two basic configurations that can be used for local wireless access—peer-to-peer and infrastructure. Peer-to-peer does not require a central access point; it works from device to device. Infrastructure uses a central access point or base station that connects to the network and can serve multiple devices within the specified radius.

802.11b supports both peer-to-peer and infrastructure use, but it is typically implemented as infrastructure. In order to set up 802.11b in this way, two types of hardware are typically used: a base station or access point and a device card. There may be one or more access points, depending on how large the service area is. The device card goes into each device (computer, handheld, etc.) that is to have wireless access. Typically, these device cards are in the form of a PC card or other similar device. Access points can cost from $179–$500 and up. Device cards are typically around $100–$400 each. Prices are expected to drop as the technology matures and economies of scale are achieved.

Bluetooth was designed to use peer-to-peer communications and is typically used this way; however, recently, the notion of an access point has been added for Bluetooth installations.

It is important to know that these various protocols are not compatible with each other. It is also important to recognize that within one type of technology, not all access points are compatible with all device cards. Because this is an emerging technology, compatibility testing of components is vital. ◆

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Resources for Wireless Networks in Schools

Becoming a Wireless Campus—www.thejournal.com/magazine/vault/A3482.cfm

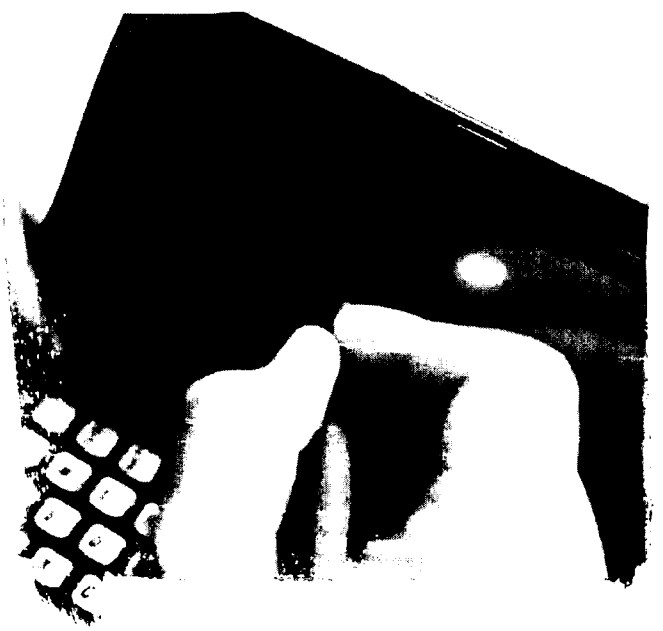
Bluetooth Group—www.bluetooth.com

eSchoolNews Report on Wireless Networking (*free, but requires a sign-up*)—www.eschoolnews.com/resources/reports/wireless0801

Three Reasons to Consider Wireless Networking—www.eschoolnews.com/news/showStory.cfm?ArticleID=1460

WiFi-WECA site—www.wi-fi.org

Wireless Laptops and Local Area Networks—www.thejournal.com/magazine/vault/A3536.cfm



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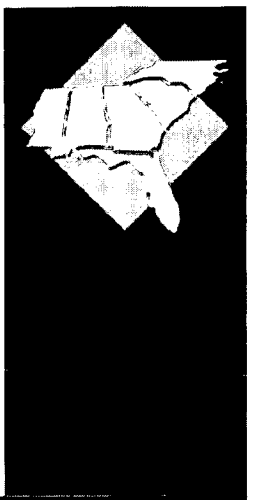
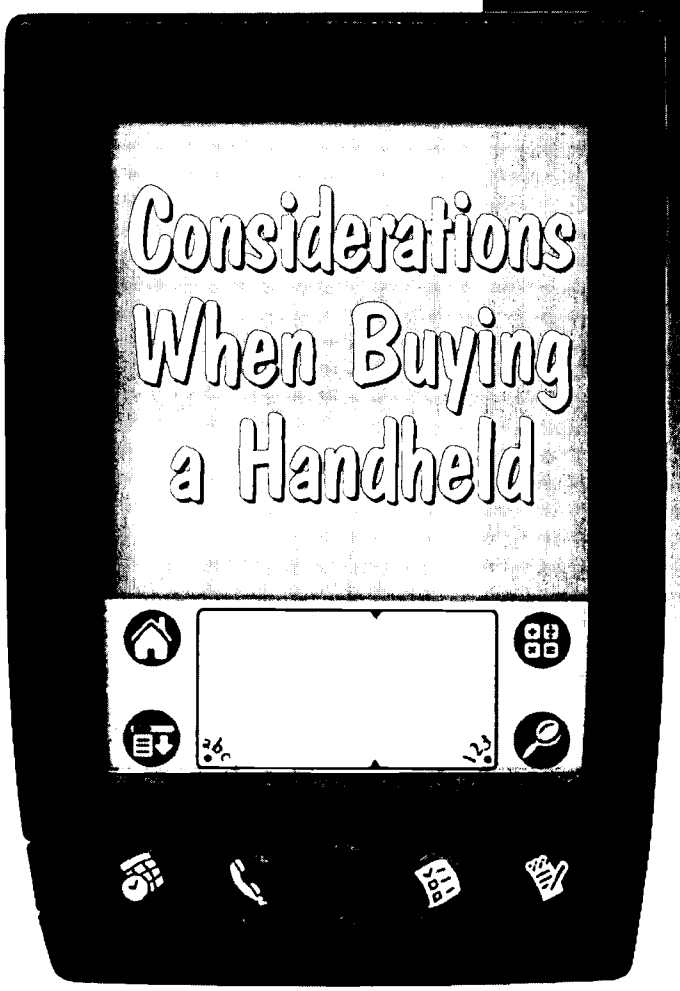
If you are thinking about buying a handheld, here are some technology considerations to keep in mind as you make your decision.



Size, Weight, Appearance

- ❑ How will you be carrying your handheld? Pocket, briefcase, purse? Since portability is the key advantage of handhelds, the device should be light and small enough so that you will take it with you. (If you are going to take it with you, does it have a case to protect it while not in use?)
- ❑ Handheld technologies vary from palmtop size to those roughly half the size of a laptop with a built-in keyboard. Which form factor makes the most sense for your use?
- ❑ Is the appearance (color and design) of the handheld device important to you?



Changeable Battery vs. Cradle-Charging System

Which is best for your specific situation?

- ❑ Some devices use a number of batteries, such as AAA, and you should always carry extras when traveling.
- ❑ Others contain rechargeable batteries that get their charge when the device is plugged into the cradle or optional portable charging adapter.
- ❑ Consider the average battery life.

Capability vs. Ease of Use

Which operating system will suit your needs?

- ❑ In general, devices using the Palm operating system are less expensive and simpler to use, but include less built-in multimedia capabilities.
- ❑ Devices using the Pocket PC operating system are more expensive, may be more complex to use, and may require more technical support; however, they include more functionality including built-in multimedia support.
- ❑ Consider which platform most of the peers with whom you will possibly be sharing data use.

Memory

How much memory does the device have?

- ❑ For Palm OS devices, 8 MB will be adequate for most users. Pocket PC device users will require more memory because of the operating system requirements.
- ❑ Is the memory upgradeable if it becomes necessary?

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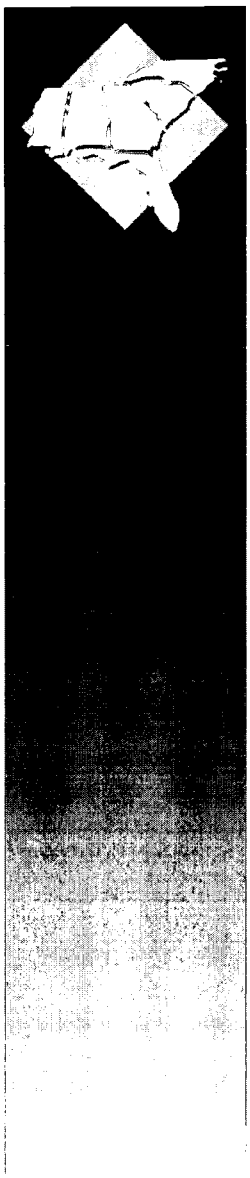


Available Software

What do you want to do with your handheld?

- ❑ Just as with desktop computers, the real power of handheld devices comes from the software applications you are able to add.
- ❑ In terms of sheer volume, the Palm OS is the clear leader, with the software library for Pocket PC slowly improving. It doesn't matter how many programs are available, but whether or not the programs you **need** are available.
- ❑ Basic desktop-type programs (databases, presentation tools, document readers, etc.) are generally available on both platforms; however, as you start to look for more specialized applications, Palm OS devices have the advantage again.

Peripherals

What kind of peripherals do you need?

- ❑ Do you need digital cameras, modems, telephones, wireless Ethernet expansion, bar code scanners, projection modules, scientific data sensors, etc.?
- ❑ Is the device Internet capable? Internet capability may be added through landline or wireless and may be built-in or added through expansion.

Screen Display

Is color display important to you?

- ❑ With most handheld devices, color displays are more readable, but monochrome displays require less power so batteries last longer.
- ❑ What is the screen resolution? Active Matrix color screens are typically higher in resolution and richer in color, depth, and brightness in various light conditions.
- ❑ Does the handheld have a backlight?
- ❑ How "readable" is the screen?
- ❑ Where will you be using this device most of the time? Be sure to consider the lighting conditions (indoor under different lighting, outdoor in direct sunlight, etc.).

Cost

What is the cost of the handheld?

- ❑ What are the up-front purchase costs of the handheld device?
- ❑ What are the costs for related things like software, expansion modules, and accessories?

References for Buying Handhelds

Buyer's Guide to Handhelds. (2002). ZDNet Reviews. Retrieved from www.zdnet.com/products/stories/reviews/0,4161,2585429,00.html.

CNET Handheld Buying Advisor. (2002). CNET. Retrieved from http://computers.cnet.com/hardware/0-5043347-7-6163347.html?tag=st.co.14448.bhed.5043347-7-6163347.

CNET Handheld Hardware Comparative Reviews. (2002). CNET. Retrieved from http://computers.cnet.com/hardware/0-14448.html?tag=st.co.1087.more.14448.

PDA Buyer's Guide. (2001, November). pdaED.com. Retrieved from www.pdaed.com/vertical/tutorials/buyersguide2.xml.

What to Look For in a Handheld. (2002). CNET. Retrieved from http://computers.cnet.com/hardware/0-2645869-7-1480993.html?tag=dir.

Educational Advantages

Why are educators considering purchasing handheld technologies for school use? The educational advantages of handhelds over full-sized, varied-functioning computers range from cost to size to ease of use. The list below is a good initial set of reasons to consider handheld devices for your school.

- **Cost**—Handhelds usually range in price from as low as $100 to as high as $1,000 depending upon the capabilities. A basic handheld for the typical student can be found in the $100–$300 range, with educational discounts available for large quantities.
- **Mobility**—This is possibly one of the biggest advantages, since handhelds can be taken practically anywhere instead of being confined to the lab or classroom. Because there is no need for electrical connections while it's being used, it can be used outside or while traveling.
- **Wireless**—The ability to transfer or share data and programs wirelessly overcomes the need for a more hard-wired infrastructure and adds to the mobility.
- **Size**—This really provides a number of benefits:
  - Physical storage of devices—Because of their small size, it's not necessary to have a separate lab for a classroom set.
  - Media storage—Devices can be loaded with electronic versions of large reference materials in a portable format.
  - **Ubiquitous access**—Users can carry them in pockets, backpacks, purses, and briefcases and always have access to information and programs.
- **Ownership**—Because of the feeling of ownership, along with the "cool factor," students take care of the devices so they don't lose the privilege of using them.
- **Access**—Because of the relatively low cost, entire classroom sets of handheld devices can be purchased for the price of three or four desktop computers and can provide access to many more students for much longer time spans.
- **Collaboration and Sharing**—Beaming has been found to be an extremely effective technique for encouraging students to work together and share information.
- **Simplicity/Ease of Use**—Particularly with the more basic educational applications, teachers do not have to spend a lot of time teaching students how to use them. ◆

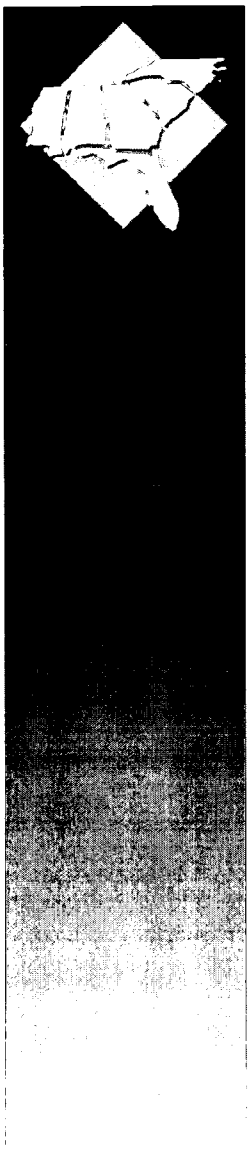
References for Educational Advantages

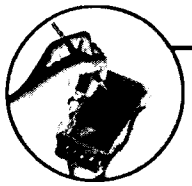
Pfeifer, R. S. (2001, May). Beaming your school into the 21st century. [Electronic version] *Principal Leadership* (High School Ed.), *1*(9), 30–4. Retrieved from **www.principals.org/news/beamingschool.html**.

Along with examples of uses of handheld computers in a Maryland high school, a number of advantages of using handheld computers are discussed.

Soloway, E. (2001, April). Making palm-sized computers the PC of choice for K–12. [Electronic version]. *Learning and Leading with Technology*, *28*(7), 32–34, 56–57. Retrieved from **www.iste.org/L&L/archive/vol28/no7**.

Describes how palm-sized computers, outfitted with suitable software, can provide the K–12 community with personal, pervasive access to networked computational resources to support student learning. The benefits of using palm-sized computers to support collaboration, sharing, and revision are discussed





Educational Concerns

Introducing handheld technologies into the school program has some potential concerns. These technologies may be small, but small does not always mean simple and easy. Consider the issues below before deciding that handheld technologies are right for your school.

- **Compatibility**—Palm OS and Windows CE/Pocket PC devices are not compatible. While some data can be interchanged, programs cannot. The other compatibility issue comes into play when a desktop computer is involved. While some programs support both desktop platforms, in general, more handheld applications are written to work with Windows desktop computers than with Macintosh.
- **Cheating**—By using an infrared port similar to that of a TV remote control, handheld computers can beam information to other handhelds. This allows students to share information easily, but it also raises the possibility of cheating since students can beam answers to each other. Fortunately, with most handhelds, there are ways to restrict beaming for this very reason. With these unique concerns in mind, your school may want to revisit acceptable use policies to ensure that potential issues are addressed. Most guidelines applied to the use of the Internet and classroom computers can be adapted to the use of wireless handheld technologies.
- **Distraction**—The very versatility of handheld devices also makes them highly conducive to off-task behavior, such as game playing or Web surfing.
- **Effectiveness/Research**—At present, we don't really know how the use of these devices affects student achievement. They haven't been around long enough for many extensive studies.
- **Infrastructure**—Although handheld computers are not expensive, peripherals such as keyboards, cameras, cases, styli, and hardware modules must also be purchased. Decisions about who needs what equipment must be made. Software must be added and regularly upgraded.
- **Ownership**—Who will own the handhelds? Students or schools?
- **Professional Development**—What resources are available for training both student and staff on the proper and effective use of handheld technologies? Even though handhelds tend to be less complicated in use, a level of professional development and orientation is required to fully utilize the technology.
- **Replacement Issues**—This includes concerns about durability and warranties.
- **Safety**—Little is known about the handheld computer's possible impact on students' health, such as eyestrain and carpal tunnel effects.
- **Screen Readability**—Even the largest handheld device has a small screen-viewing area. The issues here really revolve around the intended use of the device (extensive reading vs. quick formula calculation), the physical location of its use (lighting), and the age of the user.
- **Screen Size**—Not just readability of text but also many graphics, such as charts and graphs, do not translate well to the small size screen.
- **Security**—There are a number of security issues involved:
  - **Theft**—One of the biggest advantages of handhelds—their size—also makes them prone to theft.
  - **Data**—Developers are scrambling to build in data security safeguards like those in place for desktop computers, but it's a new field, with new concerns.
  - **Viruses**—Yes, they exist for handhelds, too. Although not in the large numbers experienced by desktop users, viruses are increasing, and virus protection programs for handhelds are becoming more popular.
- **Tech Support**—They need to be fixed in a timely manner for effective use. On the plus side, it's not too expensive to have some "loaners" available as a quick fix, which isn't really a viable option with larger, more expensive desktop models. ◆

References for Educational Concerns

Pownell, D. (2001, June). Getting a Handle on Handhelds. *Electronic School*. Retrieved from **www.electronic-school.com/2001/06/0601handhelds.html**.

Suggests questions to ask about leadership, teaching and learning, staff development, technology support, planning, infrastructure, safety, ethics, evaluation, security, curriculum, change, and equity regarding the use of handheld computers in the classroom.

Robertson, S. I. (1997, July). The use and effectiveness of palmtop computers in education. *British Journal of Educational Technology, 28*, 177–189.

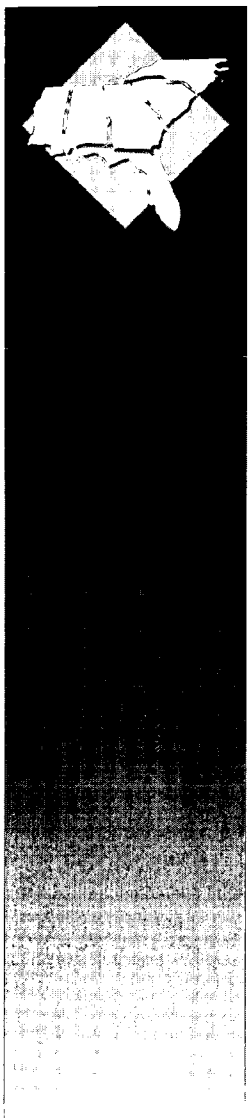
Researchers present a few problems educators found when using handhelds in the classroom (screen size, limited memory, theft of device, lost files, lack of training).

Student Teachers and High School Seniors Beam the Internet

Seniors in an English class at New Hanover High School (NHHS) in Wilmington, North Carolina, have a totally different approach to Senior Project papers and student teacher interns. As part of the Technology for Reflection and Assessment Coalition, a Preparing Tomorrow's Teachers to Use Technology (PT3) grant at the Watson School of Education at the University of North Carolina at Wilmington (UNC-W), the NHHS seniors used the Hewlett Packard Jornada handheld wireless technology to collect and organize information for their assigned papers.

Amy Hawk, one of the student teacher interns from UNC-W, used 30 Jornadas with her senior English class. The seniors used the Jornada's word processing application and its wireless Internet connection to develop a letter of intent on the research paper topic, conduct Internet research on the topic, participate in class literature research activities, and produce a final product. With the capability to beam their work to the school network and to access the Internet wirelessly whenever they wanted, the students completed their Senior Project papers in less time than their counterparts who used the school computer lab. Ms. Hawk also used the Jornadas with her sophomore English class. They used the Jornadas for word processing and Internet research as well as for class activities to create their own Anglo Saxon riddles.

Using the handheld technology in the English classes was a new but exciting experience for the student-teacher intern and is one of the UNC-W PT3 project goals of accelerating the infusion of technology throughout the teacher preparation program. Ms. Hawk reported that, for the students, the handheld devices were efficient and effective ways to manage their research and writing time and to provide greater access time to the Internet than using the one school computer lab. For her as a student-teacher intern, the devices provided instant availability to search the Web during class activities and an incentive to incorporate technology into her teaching. She noted that it is important that school administrators support using handheld technologies in teaching and learning and believe that students will benefit from the experience. This was certainly true at New Hanover High School, and it was a factor in the success of the project. ◆



101 Great Educational Uses for Your Handheld Computer

Administrative Applications

1. Keep your schedule
2. Track student progress on specific skills
3. Conduct authentic assessment
4. Use a calculator
5. Make a database of key content and concepts for student use
6. Take attendance
7. Instantly access student information, such as schedules, demographics, or parent contacts
8. Organize your reading lists
9. Take notes at a meeting
10. Record and tabulate grades
11. Track computer hardware and software inventory
12. Enhance school safety with bar code passes
13. Access lesson plans
14. Use a rubric to assess and score student work
15. Access a database of curriculum standards and related curriculum resources
16. Keep an inventory of books and materials
17. Store and track student IEPs
18. Track technical support requests
19. Keep a list of all your important contacts
20. Evaluate student teacher performance and record observation notes
21. Access a library book list
22. Track, organize, and control inventories and safety information for chemicals in the lab
23. Let students have constant access to their current grades (very motivating!)
24. Track teacher recruiting activities
25. Access human resources benefits information
26. Look up technical troubleshooting information
27. Keep emergency procedures and checklists readily accessible

Communication and Collaboration Applications

28. Send an e-mail
29. Schedule school meetings as a group
30. Collaborate on a graphic organizer
31. Send a fax
32. Make a presentation
33. Make a phone call
34. Distribute school activity information to students and parents
35. Send assignment information home to parents
36. Exchange information with a colleague
37. Have students beam in an assignment
38. Get parents' sign-offs
39. Share a downloaded Web page with someone

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40. Transfer a file from your PC for instant access
41. Write an eBook and share it with others
42. Track and exchange data on team activities
43. Receive instant messages
44. Conduct group writing activities
45. Record voice notes
46. Transmit close captioning of lectures for the hearing impaired
47. Access online educational events

Teaching and Learning Applications

48. Take and store digital photos for a report
49. Make a spreadsheet
50. Draw a picture
51. Make a concept map summarizing a chapter
52. Form, visualize, and solve equations
53. Keep track of your class schedules
54. Take notes on a field trip
55. Read an eBook
56. Find locations with a GPS
57. Take field notes by GPS location
58. Graph data
59. View maps
60. Organize your assignments
61. Gather data on temperature, light, voltage, pH, and more with data probes
62. Program your own handheld application
63. Give (or take) a quiz
64. Look up a word in a dictionary
65. Use flashcards
66. Use a tutorial for self-study
67. Do homework
68. Write a report
69. Take notes in class
70. Complete a worksheet
71. Study a foreign language
72. Listen to reenactments of historic speeches
73. Play a game that simulates the transfer of viruses
74. Do research on the Web
75. Send and receive individual or class questions
76. Gather data on transportation use, food intake, and energy use to gauge ecological impact
77. Make a timeline
78. Look up a word in a thesaurus
79. Create an outline
80. Study for a test
81. Give students step-by-step instructions or visual plans for projects
82. Keep a journal
83. See real-time data and graphs of position, velocity, and acceleration change over time
84. Access writing prompts
85. Learn to read and write Japanese characters
86. Download notes for a research paper
87. Practice multiplication tables
88. Access the periodic table
89. Use a glossary of technical terms
90. Look at reference diagrams on parts of the human body
91. Play a collaborative problem-solving game to learn about genetics
92. Listen to and study classical music
93. Build a robot controlled by a handheld device
94. Use a stopwatch to track times
95. Read about the latest current events
96. Access notes from a class lecture
97. Create a map using GPS data
98. Listen to and practice pronunciation with a voice recorder (English language learners)
99. Have classes create their own mobile information channels to share information with other classes or the community
100. Create a database on endangered species
101. Read historical primary source documents

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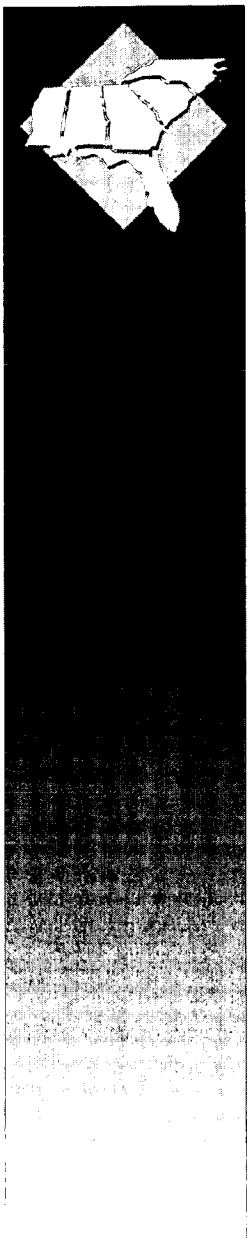
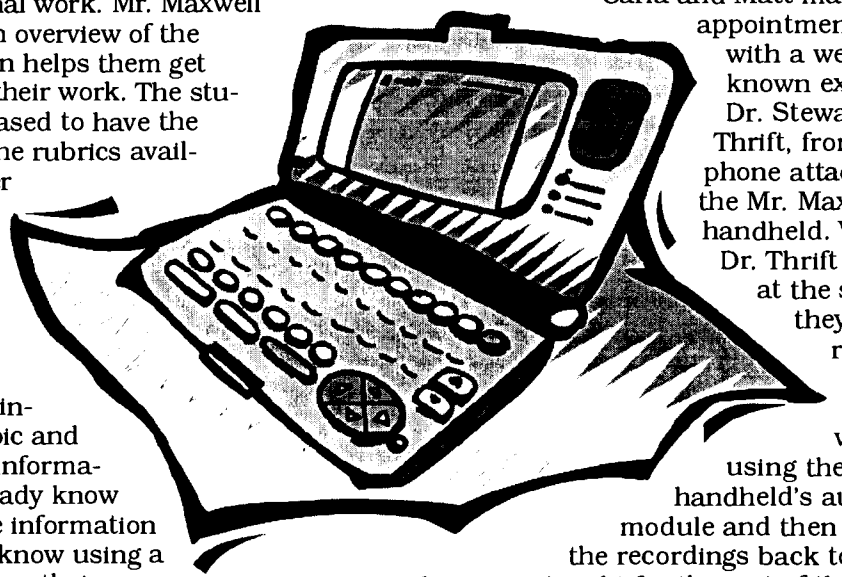


Picture This!

An exciting and innovative unit is beginning in Mr. Maxwell's class. The students are eager to find out what the topic for this week's research project will be. While the students synchronize their handheld computers, the details of their assignment are provided along with rubrics for evaluating their final work. Mr. Maxwell gives them an overview of the topic and then helps them get started with their work. The students are pleased to have the outline and the rubrics available whenever they need them.



The class is divided into several teams. Team members brainstorm the topic and organize the information they already know as well as the information they want to know using a concept map on their handheld. When they are finished, they divide the work to be done, and pairs of students take responsibility for gathering different kinds of information on their handheld computers to bring back to the group. They use the calendar function of the handheld to set deadlines for gathering information, for creating a draft report, and for the final review by all team members. They set alarms to remind them of deadlines and create "to do" lists for the whole project and for each pair of students.

Maria and Jermaine are responsible for finding appropriate images for the topic. They head to the media center and search for clip art and public domain images, download them to the computer, convert them to images for their handheld, and make notes, including the citations, about each image.

Margaret and Bill create a vocabulary list by consulting with each team, doing some basic library research, and typing their notes into their handheld computers; they use their handheld computer dictionary and thesaurus modules to create a glossary for the project.

The job of interviewing several experts is assigned to four students—Carla, Beth, Matt, and Jeremy. They access the Internet's yellow pages to find some experts in the community and then make a list of questions they will ask each expert.

Carla and Matt make appointments with a well-known expert, Dr. Stewart Thrift, from the phone attached to the Mr. Maxwell's handheld. When Dr. Thrift arrives at the school, they record their interviews using their handheld's audio module and then take the recordings back to the classroom to edit for the rest of the group. Beth also snaps a few pictures of Dr. Thrift and some of the artifacts he brought with him using the digital camera attached to her handheld computer.

Meanwhile, Beth and Jeremy find that one of the teachers in the school, Mr. Samuel Justice, is also an expert on the topic. They e-mail him from their handheld computer, and he responds that he'd be willing to answer any questions, but it would be easiest for him to work by e-mail. The next morning, they find his answers waiting for them when they check their e-mail on their handheld computer. They export the e-mail to a word processor and edit the interview.

Robbie and Barbara use their handhelds to search for specific information on the Internet right from their classroom. They summarize the information using the word processing program on one of their handheld computers.

Miguel and Sarah find that their school has several books on the topic, and the media specialist helps them download the electronic book version of one critical

work to their handhelds so that they can review it in the classroom.

Sydney and Logan collect data from a variety of sources, including probeware they borrow from the science teacher. They enter the data into a spreadsheet program on their handhelds and then calculate and sort the data. They use this data to generate several charts and graphs for use in their final report.

The team beams information to each other from time to time so that they all share the information that each person has found. Using one of the classroom computers and a presentation template, they each create a portion of the presentation and then combine the portions into one final product. They refer to the document on their handhelds that contains the rubrics Mr. Maxwell provided, checking each item to be sure they have included everything required.

Now it's time to show the presentation. They send the presentation over the school network to the presentation-station handheld and take turns explaining their findings to the rest of the class. Their classmates evaluate the presentation and beam their results to Mr. Maxwell, who adds his comments and then shares them with the team. To be sure each student has mastered the basics of the topic, Mr. Maxwell prepares a short quiz with true-false, multiple choice, short answer, and one challenging essay question on his computer. The students download the quiz, and when they take it, the handheld locks out access to any other information on the device until they have beamed the answers to the teacher.

All the students are excited about what they have learned and prepare a Web page to share their presentations with their parents and the community. Mr. Maxwell e-mails the parents with the URL and invites them to access the students' work. Sydney's mother gets the e-mail on her handheld computer on her way home from a business trip and, while waiting at the airport, takes a look at the class's work. She is proud of her daughter and tells her so when she gets home. She e-mails the teacher as well. Mr. Maxwell receives the e-mail just as he finishes synchronizing his handheld computer with his desktop computer, transferring the grades and comments for each student and recording their progress against the standards and benchmarks the district curriculum requires.

Time to begin a new project? The students are ready to take on new roles and responsibilities. As long as they have their handheld computers, they know they can do the job. ◆

More Uses, Ideas, Software, and Case Studies for Handhelds in Education

Center for Highly Interactive Computing in Education (Hi-Ce), University of Michigan—www.hi-ce.org

Reports on the Center's development of a variety of free handheld applications for education

K12 Handhelds—
www.k12handhelds.com/casestudy

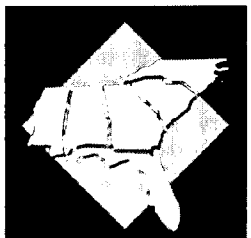
Provides case studies on the use of handhelds in education

Palm in Education—
www.palm.com/education

Includes case studies, programs, research, and resources

PEP Ideabank—
www.palmgrants.sri.com/ideabank.html

Provides links and innovative ideas for using handhelds in education

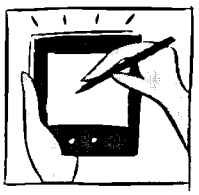


Using Handheld Technologies in Schools

The Beaufort County Schools (South Carolina) and the Johnston County Schools (North Carolina) have both undertaken pilot projects involving the use of handhelds in the classroom. In the following interview, Cyndi Pride, Beaufort County Schools' Curriculum and Instruction Technology Specialist, and Diana Skinner, Johnston County Schools' Technology Director, share their experiences with their handheld technologies projects and offer some lessons learned. The experiences of these two districts provide insight and guidance for others interested in this use of technology.

Beaufort County Schools Project

- 270 students in grades 4–12



Johnston County Schools Project

- 5 schools, 60 students per site
- Participants included:
  - All district principals (32)
  - All technology leaders (32)
  - 35 media coordinators
  - Superintendent's Administrative Cabinet members (6)

SEIR◆TEC: Why did your school district initiate a project on using handheld technologies in the classroom?

Diana: Both the Assistant Superintendent for Technology, E.D. Hall, and I had owned a Palm Pilot for a number of years and had become addicted to the tool. Upon reading articles from professional journals and visiting vendors at conferences, we purchased some devices and experimented with them for educational value. I prepared a PowerPoint presentation to answer questions regarding use, cost, and educational value that I then showed to teachers and administrators. We applied to be a Palm Education Training Provider (PETP) trainer and attended training conducted by Palm in May 2001 in San Jose, California. Endowed with a lot of resources and materials, probes, software, and training materials, we began our initiative in summer 2001.

E.D. Hall

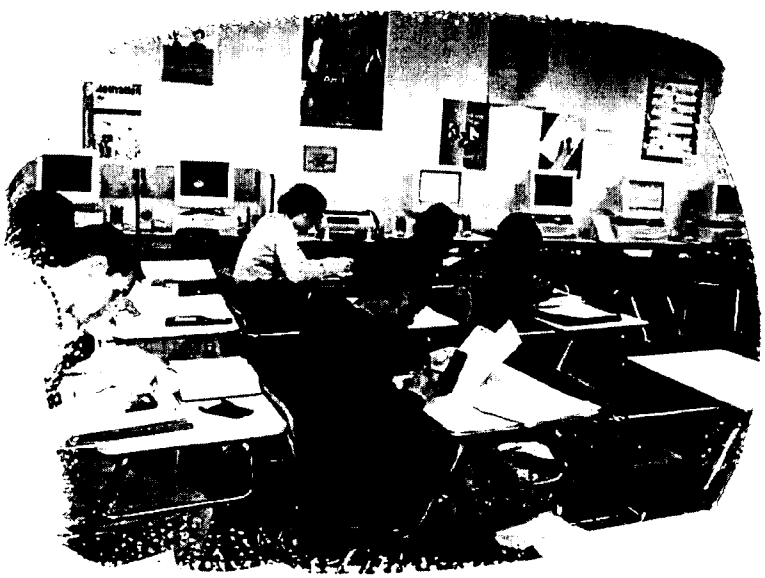
Cyndi: Our first handheld technologies program involved teachers and grew out of the recognition that the handheld, long used in business applications, could provide a means for teachers to have one ready-at-hand tool to collect and manage digital data about teaching activities and student learning. The handheld would provide the teachers with a means to more easily collate student information into a meaningful report, eliminating double entry and reiterative behaviors. Placing handhelds into the hands of students seems to be a logical next step. The handheld promotes equity in access at an affordable price, allowing us to bring more technology into the classroom. The size and portability allows for ease of movement from class to class and promotes use in the field. Although the size and weight of the handhelds would seem to increase the chance of technology "walking out the door," this has not been an issue.

SEIR◆TEC: Tell us about your project: goals, who is/was participating, how long it has been/was in operation, and products you used.

Diana: Our pilot this year has been investigative and administrative in nature. We have placed 30 Palms in the hands of fifth-graders, sixth-graders, eighth-graders, and eleventh-graders with a different curriculum focus for each grade. The Palms have been used for language arts, math, science, computer skills, and writing assignments. We are also investigating their use as a communication device between home and school. All principals, media coordinators, technology leaders, and most Advanced Placement teachers have Palms, as do our central office administrators. This is a study to remove paper (for example, meeting agendas), to share information and technology tips, and to access data as a PDA. Administrators are accessing student information; parents and students are accessing homework and school calendars, and teachers are accessing observation notes. We began in September 2001 with administrative training and in October with training of students and teachers. We are using a variety of Palm products—m100, m105, m505, 111c, and 5vx. Our software varies by curriculum, but we all use Docs To Go, PiCo Maps, Imageware, Notepad, Handy Sheets, and Cooties.

Cyndi: The goal of our first project (Assessment...It's in the Palm of Your Hand) was to provide teachers with a tool (Palm) to assist them in managing data from a variety of assessments to gain a better picture of student learning and thus to guide instruction. Nineteen teachers participated in the program, beginning in February 2001, with a review of literature on the topic of assessment. Training was provided in the mechanics of using the Palm, including entering information, synchronizing the Palm, and transferring data from one application (for example, the Memo Pad) to another (for example, a Word document). Teachers used the basic Palm applications, a spreadsheet application, and Teacher's P.E.T., a grade book and learning management program. Additionally, each teacher reviewed and evaluated other software that might be applicable in a teaching environment. At the beginning of our project, there were only a few software applications specifically for educators, but now more are available, as developers have discovered this unique niche. Titles that were reviewed include Learner Profile to Go, Thought Manager, and Praesto Grade, to name a few. The teachers met weekly through the spring and continue to meet monthly, to share information, ideas, tips, and tricks.

As a recipient of a Palm Education Pioneer (PEP) Research Hub Grant, Beaufort County School District was able to expand the program to include students in the fall of 2001. Two hundred seventy students in grades 4–12 use Palm Pilots to determine if the Palm helps students be more cognizant of their achievement because of the opportunity for self-assessment in project-based learning activities. We have three different models in the program: classes where students are issued Palms and use them at school and at home, class sets of Palms that are shared by several students for special projects, and daily



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in-class use of Palms by assigned students. Teachers and students make extensive use of freeware, such as Hi-Ce's PiCo Map and Cooties (www.handheld.hice-dev.org), Big Clock, and Diddlebug. As the program evolves, and new software applications are developed, we expect that schools will begin to budget for additional software. Some of our schools have augmented the Palms with peripherals including keyboards, digital cameras, and probeware. Several of our schools have purchased additional Palms for both student groups and teachers. Teachers in primary school classrooms are using the Palms, in part, to collect data for the South Carolina Readiness Assessment. Additionally, we have two schools that have purchased class sets of Pocket PCs, keyboards, and some wireless cards.

SEIR◆TEC: What was the reaction by students to the handheld technologies? Teachers? Administrators?

Diana: They love them and want more devices! Those schools not involved in the pilot want to be included. We have even had a few parents purchase them for their students so the students did not have to share the school-provided Palm. Everyone wants us to develop more grant proposals to obtain more Palms!

Cyndi: Most users have met the handhelds with enthusiasm: teachers, administrators, and students alike. All users appreciate the simplicity of the Palm interface and the avenues for communication and collaboration that result from being able to beam data from one Palm to another. Teachers, especially, appreciate the ability to carry the Palm everywhere and to take or refer to notes anytime. Although some may think this insignificant, teachers have commented that women's clothing does not always have pockets or belts, so some users carry alternatives, such as small shoulder bags and special lanyards.

Administrators at several schools have also adopted handhelds. Administrators are using both Palm OS and Pocket PC platforms. Administrators are interested in synchronizing student information data (SASIxp) onto their handhelds for anytime/anywhere access to student schedules, teacher schedules, bus assignments, and discipline records. With few exceptions, our users find their Palms to be indispensable. I have even been treated to more than one round of applause from students when introduced as the person who was responsible for the grant that got the students the Palms!

SEIR◆TEC: Describe the training you conducted and tell us what training you think is essential for anyone considering a handheld implementation for the classroom.

Diana: Our training is systematic and thorough. Only two of us conduct initial training, but teachers and technology leaders work with teachers and students at each grade level. For phase one, it is extremely important that small groups are trained well and supported as they have questions and develop ideas. We are producing a training manual and software recommendations as "must haves" to affect student learning and achievement. We will share these at conferences and with other counties in North Carolina. You must have a cutting-edge team always ready to test the new software and devices. Lessons we learned were to set and maintain standards, to retain plenty of written documentation, to have clear objectives as to why to use the Palms, to do follow-up training, and to adjust training as necessary.

Cyndi: Many of our users found that organized training for the Palm was not necessary, but a few workshops were made available to less assured teachers, administrators, and even board members. To get users started, we offered an introduction to the Palm applications, buttons and screen views, preferences, creating and using catego-

ries, tapping, typing, and beaming. The second workshop encompassed skills such as changing settings for buttons, using the shortcut stroke, and creating shortcut commands, phone lookup functions, and menu options. During training sessions, dialogue about classroom applications was encouraged, and tips and tricks were shared among users. Another training opportunity assisted users in loading the Palm desktop software and synching with Outlook and reviewed how to add programs to the Palm. Although we didn't have formal training for specific software titles, the teachers met to share notes and assist each other with these new applications. Teachers using the Pocket PC handhelds were able to adjust to the CE versions of Word and Excel with little difficulty, once they understood the mechanics of tapping and typing. Teachers using this platform met for several hours to experiment with the tool and to brainstorm ways in which to use the handheld with students in the classroom. They received instruction in the class, along with the students, on how to connect to the network using wireless cards. Each school has a lead teacher who assists other users if problems or questions arise. In some schools, the lead teacher received the handheld prior to other teachers and had the opportunity to practice with its use and to participate in training. The teachers became the primary instructors for their students. Some teachers offered additional training for parents so they could use the Palm to correspond with the teacher. In schools where the Palms go home with the students, teachers and parents have begun to communicate with each other in the Memo Pad application. Although training is not essential, it can help teachers maximize the utility of the handheld. Several of our teachers and administrators had used their Palms independently for a period of time, but many had not discovered special timesaving features, such as how to create shortcuts and use the shortcut stroke to make notations faster. Synchronizing the handheld and working with e-mail is problematic for some users. Additional training may also be required for wireless connectivity in future models.

SEIR◆TEC: What were the most successful uses of the handheld technologies by students? Teachers? Administrators?

Diana: For students, the most successful uses were the calendar, PiCo maps, and probes. For teachers, it was the Handy Sheets website with digital worksheets for the Palm. Administrators really used the Doc To Go for teacher performance assessment.

Cyndi: One of the greatest benefits of the handheld is the ability to share information via infrared. Our teachers and students have capitalized on this feature. In a drama class, the teacher beamed scripts to the students in Memo Pad. Students also have journal questions beamed to them frequently, which they respond to, and either beam back their responses or sync their handhelds to the class computer. Beaming allows students to work collaboratively as well. In one class, students built sentences to review sentence structure and parts of speech. Students have also been able to work collaboratively to share research findings. In classes where we have used PCs connected to the Network, students were able to take notes from different sites on the Internet and then share those, by beaming, with other students. Students have also received a project "to do" list elaborating the steps of a project, which they can check off as each phase is completed. Teachers and students have worked together to define levels of accomplishment as a rubric for specific assignments. This can be beamed to students for reference as they complete the task. Students have used the Address Book feature to keep contact information for study

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buddies, and the calendar feature is used to track assignments. The alarm feature of the calendar has been especially useful to remind students as long-term assignments come close to their due date. The calculator is helpful as it eliminates the need for another tool. Some math teachers have especially liked the fact that students can view, copy, and paste "recent calculations" into a memo, where they can describe their solution step-by-step. One high school teacher has used a demo version of MathWorks (www.imagiworks.com) that allows the Palm to function like a graphing calculator. She plans to purchase this software for students next year.

SEIR◆TEC: What recommendations would you offer to schools and districts considering implementing handheld technologies?

Diana: Even though we have only worked with the handhelds a short time, we highly recommend a four-step process: pilot, support, train, and support some more. We would also recommend gathering data and documenting and sharing the lessons learned with others. This is how we have built justification for extending our project and obtained new ideas to try.

Cyndi: The first decision schools or districts must make before implementing a program is what handheld platform to purchase and support. Currently, we have programs with each platform, and we will be reviewing the pros and cons for each as we move forward. Another consideration in purchasing a handheld is power. Generally, it is easier to recharge units than to constantly replace batteries. Schools will need to plan for how they will recharge a number of units; however, the cradle or charging cord is included in the purchase price. Although there is much to be gained in using the handheld straight out of the box, peripheral equipment and optional software greatly increase the utility of the technology. Therefore, planning for additional expenses is wise. From our experience, we feel it is important that the first teachers selected for the program have a basic comfort level with computer technology. Synching to the computer and moving documents from memo pads to Word and back might be intimidating to some teachers.

Although formal training does not seem to have been a key indicator of success in using handhelds effectively in our projects, our teachers have commented that they benefited greatly from having the opportunity to talk with other users and share ideas. It has also proved helpful to have a designated point person in each building who is well versed in the workings of the handheld platform selected for the school. One other consideration is whether the handhelds will be used strictly in the classroom and during the school day, perhaps on field trips, or whether they will go home with students. ◆

Using eBooks on Handhelds

Electronic books, or eBooks, are electronic versions of books, magazines, journals, reference manuals, textbooks, or any other document traditionally occurring as a printed volume. Electronic books can be viewed on a traditional computer screen and are also becoming increasingly popular on smaller, portable reader devices, including handheld devices. The appeal of these devices is that they can be carried around, much as a traditional book might, but can also contain numerous volumes and special features that are not available in the print versions of books.

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Book Document Formats

Format	Description	Compatibility
Doc	This is a common eBook format and works on a wide variety of platforms and with most viewers. *(Note: This is not the same as the .doc files of Microsoft Word.)*	Palm, PPC, EPOC
isilo	Offers higher compression and extended formatting capabilities	Palm
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MemoPad	Imports directly into Memo Pad; limited to 4K	Palm
MobiPocket	Offers extended formatting capabilities and support of multiple platforms	Palm, PPC, EPOC
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Using Handheld Computers in Education: A Sampling of Projects

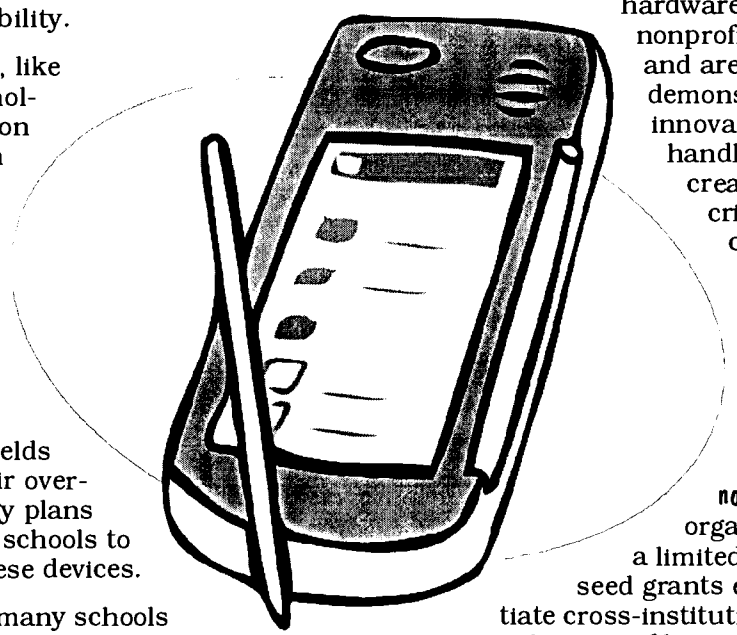
Key Uses	Users	Reference
◆ Gathering data ◆ Beaming ◆ Reference ◆ Word processing ◆ Scheduling ◆ Organization	◆ High school students and teachers	*Consolidated High School District 230 makes use of handhelds.* An overview of a large handheld pilot involving nearly 1,700 students and 65 teachers. **www.d230.org/Handheld**
◆ Organization ◆ Data gathering ◆ Beaming	◆ High school students and teachers	*Handhelds go to class*—New short film and story. A large school district equipped students and teachers with 2,200 handheld computers in the fall of 2000. According to English, biology, and social studies teachers in the district, use of the handhelds has increased student productivity and efficiency across all disciplines. **http://glef.org/orlandpk.html**
◆ Communication ◆ Organization	◆ All teachers and administrators	Leeuwenburg, Todd. (January 1999). *Dick Tracy goes digital.* Electronic School. An early, but still applicable, discussion of the professional uses of handhelds for educators. **www.electronic-school.com/199901/0199toolsofthetrade.htm**
◆ Databases ◆ Spreadsheets ◆ Presentations ◆ eBooks	◆ High school students	*High school students learn workplace skills with Palm handhelds.* A team of students in a school-to-work program use handhelds as an efficient way to manage jobs, equipment, and personnel and to share information and communicate easily. **www.palm.com/education/studies/study14.html**
◆ Schedules ◆ Student database ◆ Data gathering ◆ Probes ◆ Beaming homework ◆ Other possibilities	◆ High school administrators, students, and bus drivers	Stover, Del. (March 2001). *Hands-on learning.* Electronic School. One company wants to use bar-code scanners to allow bus drivers to record the pickup and delivery of students by scanning their ID cards. Principals use the handhelds as a tool that allows them to check their schedule on the fly, determine if a student in the hallway is supposed to be in class, or jot down a note for later reference. **www.electronic-school.com/2001/03/0301f4.html**
◆ Probes	◆ Middle and high school students	*Handhelds and probes become keystone of learning environment.* This describes a mobile learning environment that makes it easy to collect and analyze scientific data and to collaborate between classes and schools. **www.palm.com/education/studies/study15.html**
◆ Organization ◆ Graphing calculators ◆ Note-taking ◆ Reference tools ◆ Internet access	◆ High school special education students	*Independence.* Describes a project to help special education students excel through the use of handheld technology. **www.palm.com/education/studies/study3.html**
◆ Student database access ◆ Coordinating professional schedules	◆ Administrators	*Pushing barriers.* Providing administrators with instant student information and productivity tools. **www.palm.com/education/studies/study4.html**
◆ Internet access ◆ Reference tools	◆ Middle and high school students	*E-WIRE.* (January 2001). Electronic School. Highlights several applications of handheld computer usage in a variety of classroom settings. **www.electronic-school.com/2001/01/0101ewire.html**
◆ eBooks ◆ Organizers ◆ Probes ◆ E-mail assignments ◆ Downloadable worksheets	◆ High school teachers and students	Thomas, Karen. (May 28, 2001). Inexpensive handheld PCs find way into classrooms. *Detroit News Online.* Discusses a high school where all 450 ninth-graders and 30 teachers were issued handheld computers. **http://detnews.com/2001/technews/0105/28/a11-228994.htm**

Key Uses	Users	Reference
◆ Searchable reference tools ◆ Internet access ◆ Schedules ◆ Assessment ◆ Electronic flashcards	◆ University medical students	Stanford University School of Medicine Palm Project— This project was created to improve the experience of Stanford medical students by making available educational tools that are mobile, comprehensive, and interactive. **http://Palm.Stanford.edu**
◆ Internet access ◆ Concept mapping	◆ High school students	Trotter, Andrew. (September 26, 2001). Handheld computing: new best tech tool or just a fad? *Education Week*. Descriptions of a variety of pilot projects using handhelds in different subject areas, along with some of the educators' concerns. **www.edweek.com/ew/ew_printstory.cfm?slug=04palm.h21**
◆ eBooks	◆ All students	Flanigan, Robin L. (March 2001). *Tools of the trade*. Electronic School. Discussion of eBooks with examples from a number of different school pilot studies. **www.electronic-school.com/2001/03/0301toolsofthetrade.html**
◆ eBooks	◆ High school students	Pickett, Debra. (June 26, 2001). Will handheld devices replace textbooks? *Chicago Sun-Times*. Highlights the use of the goReader in a junior class on American literature. **www.suntimes.com/output/tech/conf26.html**
◆ Assessment ◆ Grading ◆ Class management	◆ Physical education teachers	Dorman, Steve M. (May 1998). Enhancing school physical education with technology. *The Journal of School Health*, 68(5), 219–220. The use of handheld devices that assist with fitness testing, grading, and class management is increasing. These devices help the physical educator collect and input information in the classroom or in an outdoor setting.
◆ Digital imaging & captioning ◆ Beaming	◆ Elementary students	Vandenabeele, Janet. (July 23, 2001). Science class gets boost: Handheld computers enhance school's enrichment lessons. *Detroit News Online*. Describes a summer program that utilizes handhelds packed with educational software. **http://detnews.com/2001/schools/0107/23/c03-252214.htm**
◆ Barcode scanners ◆ Radio Frequency Identification (RFID) tags ◆ Beaming ◆ Web access ◆ Reference ◆ Circulation systems ◆ eBooks ◆ Policies	◆ Media specialists	Embrey, Theresa Ross. (March 2002). *Today's PDAs can put OPAC in the Palm of your hand*. This article contains a wealth of current and possible future uses of handheld devices in the media center. **www.infotoday.com/cilmag/mar02/embrey.htm**
◆ Scheduling ◆ Web access ◆ Reference ◆ Organization	◆ High school teachers and administrators	McCampbell, Bill. (March 2001). Taking a look at pocket digital assistants. *Principal Leadership*, *1*(7), 72–74. Course schedules and assignments put on a class Web page and updated to PDAs using the sync capability. Supplemental reading material can be posted to students' devices. Calculators, conversion charts, checklists, and other class paraphernalia replaced with handhelds.
◆ Organization ◆ Word processing ◆ Scheduling ◆ Beaming ◆ Presentations ◆ Professional collaboration ◆ Assessment ◆ Data gathering ◆ Classroom management ◆ Internet access ◆ E-mail	◆ All teachers	McFadden, A., Price, B.J., & Marsh, G. (September, 2001) *A valuable technology tool for student teachers*. Three University of Alabama educational-technology experts describe how handheld computers can enhance productivity, classroom information management, and instructional support. While it targets student teachers, many of these scenarios apply to any educator. **www.glef.org/pdatool.html**

Grant Opportunities

Any grant opportunity for educational technology is one that can be tapped for handheld computers. Just remember to address the specific grant requirements by including handheld applications and programs that address specific instructional goals. For example, if you are writing a grant for materials to support science instruction, you might include handhelds, science data probes, curriculum materials, graphing calculator software, and digital cameras. In addition, make sure to emphasize the way that handhelds can address equity and access issues because of their low cost and mobility.

Some grants, like Texas' Technology Integration in Education (TIE) grants, even specifically allow handhelds as an eligible use. Progressive states are starting to make handhelds a part of their overall technology plans and funding schools to purchase these devices.



In addition, many schools are using professional development grants to purchase handheld workshops (some of these include handheld devices in the cost). This is a creative way to fund professional development and the handhelds themselves all in one.

Here are a few grants that are specifically geared toward handhelds:

Palm Education Pioneer Grant Program—This program gives Palm handhelds to K–12 teachers and their students so they can use them in new ways for teaching and learning. This program is administered by SRI International's Center for Technology in Learning. It is limited to hardware grants. While the program does not have a next round of grants scheduled at the time of this writing, check their website at **www.palmgrants.sri.com**. This website also has many great ideas about how to use handhelds in education.

Handspring Foundation Grants—This foundation offers both cash and product grants to qualifying organizations. The cash grants are made to nonprofit organizations that focus on issues relating to children and youth who are at risk. These grants range from $1,000 to $25,000. The product grants provide hardware to qualified nonprofit organizations and are geared toward demonstrations of an innovative use of handhelds that will creatively address critical community concerns. More information is available at **www.handspring.com/company/foundation**.

Center for Innovative Learning Technologies—This organization offers a limited number of seed grants each year to initiate cross-institutional collaborations in the area of learning technologies. The themes of the program are Visualization and Modeling, Ubiquitous Computing, Community Tools, and Technology in Learning Assessments. The range of award is $6,000 to $15,000. More information can be found at **www.cilt.org/seedgrant/projects.html**.

TI-Navigator Collaboration Grants—This program awards grants that allow for the purchase of the TI-Navigator system at a reduced price of $5,500 versus the list price of $9,800. For more information, call the TI-Navigator Collaboration Grants office at 866 846-2844 or e-mail them at **ti-navigator@ti.com**.

There are some other organizations that offer grants in the general area of educational technology and have funded handheld projects in the past. One such organization is Intel. Check out its website at **www.intel.com/education/grants**.

Also, make sure to check with your state educational technology office to see what educational technology and professional development grants they have available.

As with any grant application, the following tips are useful to remember when you are writing grants for handheld programs:

- Read the grant request for proposal carefully and tailor your proposal to those requirements.
- Focus on student achievement and the improvements your proposed program will make; make sure to indicate specific and measurable objectives.
- Design a program that can be replicated by other schools and include how you will share information about your experience with others.
- Make sure to include information on how your program will be evaluated.
- Make the budget detailed, reasonable, and representative of the rest of your proposal.
- Make sure you meet all the technical requirements of the proposal.
- If your program doesn't get funded by this grant, try again. Many wonderful programs aren't funded the first time around. ◆

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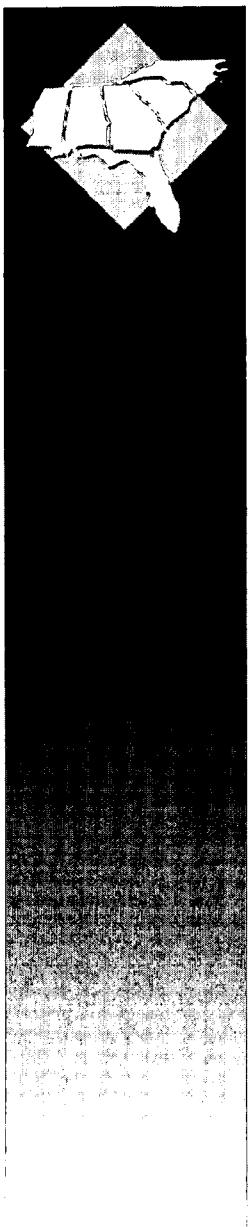

Professional Development and Handheld Technologies

Connected University's Pocket CU—A prototype of an online class utilizing a handheld device as the delivery medium. The content for this class is "Teaching to Standards." **http://cu.classroom.com/palm**

K12 Handhelds—A variety of both on-site workshops and online courses that start with an introduction to handhelds for beginners and then build to more advanced courses that focus on applications for administrators, teachers, and students. **www.k12handhelds.com/dev.php**

Palm PETC Program—The Palm Education Training Coordinator (PETC) program is a train-the-trainer program designed to support K–12 in-service and pre-service professional development programs focused on the educational uses of Palm handheld computers. **www.palm.com/education/training**

Palm PETP Program—Regional workshops conducted by Palm Education Training Providers (PETP). PETPs are Palm Certified Trainers with expertise in the Palm OS and years of personal experience as K–12 educators and administrators. **www.palm.com/education/programs/regional**

Note: A few universities, colleges, and private training centers are now offering distance education courses that are designed around handheld delivery methods. For example, Brigham Young University offers a high school course for U.S. History that is taken with Palm OS devices in addition to the traditional computer connected to the Internet.

Sample Educational Software

Productivity Tools (Teachers and Students)

TITLE	DESCRIPTION	WEBSITE	TYPE	HANDHELD OPERATING SYSTEM	DESKTOP COMPONENT AVAILABLE
ClassPro	Digital organizer specifically designed for students.	*www.developerone.com/pocketpc/classpro*	Commercial product	Windows CE	Win
Documents to Go (Dataviz)	Allows users to transfer Word, Excel, and PowerPoint to the handheld, view and edit files, then transfer back to the desktop computer.	*www.dataviz.com/products/documentstogo/index.html*	Commercial product Free demo	Palm™	Mac/Win
ePrincipal Mobile (Media-X)	School analysis of grades, learning skills, attendance, at-risk students, and standardized tests.	*www.media-x.com/products/eprincipal/mobile.php*	Commercial product Free demo	Palm	Mac/Win
eStandards (Media-X)	Curriculum standards databases (currently available for California, Texas, Florida, Wisconsin, Kansas, and Ontario; other states and districts under development); also allows the creation of your own database of standards for browsing and tracking.	*www.media-x.com/products/estandards/index.php*	Commercial product Free demo	Palm	Mac/Win
eTeacher Mobile (Media-X)	Standards-based planning, assessment, and reporting for teachers, including rubric-centered assessment. (Note: Requires desktop program to create student lists, standards lists, activities, rubrics, learning skills, etc.)	*www.media-x.com/products/eteacher/mobile.php*	Commercial product Free demo	Palm	Mac/Win
Go 'n Tell (Hi-Ce)	Allows you to create a virtual scrapbook with pictures and text that can later be converted into a website.	*www.handheld.hice-dev.org/download.htm*	Free product	Palm	Mac/Win
HandBase Plus (DDH Software, Inc.)	An information management tool (database) that can be used for homework assignments, student attendance, project management, and student assessment.	*www.ddhsoftware.com/software.html?view=handbase*	Commercial product Free demo	Palm/ Windows CE	Mac/Win
HandySheets (Hi-Ce)	Create customized worksheets, download them to students, and then collect them for grading.	*www.handheld.hice-dev.org/download.htm*	Free product	Palm	Mac/Win
Learner Profile To Go (Sunburst)	Handheld extension to Learner Profile on the desktop; lets teachers assess classroom learning, evaluate student portfolios, and collect anecdotal records. (Awaiting release.)	*www.sunburst.com*	Commercial product	Palm	Mac/Win
Making the Grade (Grade-busters)	Gradebook and attendance tool.	*www.gradebusters.com*	Commercial product Free demo	Palm/ Windows CE	Mac/Win
PiCoMap (Hi-Ce)	Concept mapping tool.	*www.handheld.hice-dev.org/download.htm*	Free product	Palm	Mac/Win

Quizzler Pro	Makes and delivers quizzes.	*www.quizzlerpro.com*	Commercial product Free demo	Palm/ Windows CE	Mac/Win
Student Teacher (Scholarus Wireless)	A wireless resource for student teachers; contains lesson plans, tips, rules and regulations, and other educational resources.	*www.pocketgear.com/ software_detail.asp?id=1342*	Commercial product	Windows CE	N/A
Teacher's P.E.T. (Coffee Pot Software)	Manages grading, attendance, and contact information for up to ten classes.	*www.coffeepotsoftware.com*	Commercial product Free demo	Palm	Mac/Win
TeachFile (EddieSoft)	Provides classroom management, tracking assignments, attendance, and general status information.	*www.eddiesoft.com*	Shareware	Palm	Win
ThoughtManager for Teachers (HandsHigh Software)	Organizes ideas, projects, agendas, notes, task lists, speeches, class outlines, and more.	*www.handshigh.com/html/ tmteachers.html*	Commercial product Free demo	Palm	Win
Tracker (True Image Management Systems)	Provides access to student information system, such as student schedule and emergency contact information.	*www.schoolid.com*	Commercial product	Palm	Mac/Win
Classroom Wizard (Scantron)	Handheld quiz-to-desktop grading and data assessment.	*www.classroomwizard.com*	Commercial product Online demo	Palm	Win
WordSmith (Blue Nomad Software)	A full-featured word processor, document viewer, and enhanced memo pad.	*www.bluenomad.com*	Commercial product Free demo	Palm	Mac/Win
FreeWrite (Hi-Ce)	A word processor, featuring a 109,000-word spellchecker.	*www.handheld.hice-dev.org/ download.htm*	Free product	Palm	N/A

Communication and Collaboration Applications

TITLE	DESCRIPTION	WEBSITE	TYPE	HANDHELD OPERATING SYSTEM	DESKTOP COMPONENT AVAILABLE
AvantGo Mobile Internet Service	Provides access to personalized Web-based content; includes news, maps, stock updates, educational information, and more.	*www.avantgo.com*	Free product and online service	Palm/ Windows CE	Mac/Win
Blazer (Handspring, Inc.)	Web browser.	*www.handspring.com/ software/hs_software.jhtml*	Commercial product	Palm	N/A
eHomeRoom.com	Collects, aggregates, and tracks school activities in one integrated calendar for administrators, teachers, parents, and students.	*www.ehomeroom.com*	Commercial product Free demo	Palm	Win

Communication and Collaboration Applications (continued)

TITLE	DESCRIPTION	WEBSITE	TYPE	HANDHELD OPERATING SYSTEM	DESKTOP COMPONENT AVAILABLE
Eudora Internet Suite (Eudora)	E-mail and browser bundle.	*www.eudora.com/internetsuite/eudora4palm.html*	Free product	Palm	Mac/Win/Linux/Unix
Fling It (Hi-Ce)	Takes any Web page from desktop computer and sends it to your handheld to be viewed offline.	*www.handheld.hice-dev.org/download.htm*	Free product	Palm	Mac/Win
Scholastic Wireless	Provides educational content for students and planning tools for teachers.	*http://teacher.scholastic.com/wireless/index.htm*	Free online service	Palm/Windows CE	N/A

Reference

TITLE	DESCRIPTION	WEBSITE	TYPE	HANDHELD OPERATING SYSTEM	DESKTOP COMPONENT AVAILABLE
Alex Electronic Texts (Infomotions, Inc.)	Online collection of digital documents.	*www.infomotions.com/alex*	Free online resources	Palm	N/A
Atlas CE	Comprehensive almanac with statistics, flags, population, languages, etc.	*http://pocketgear.com*	Commercial product Free demo	Windows CE	Win
Franklin Reader (Franklin)	eBook reader with search capabilities.	*www.franklin.com/estore/download/fepreader.asp*	Free product	Palm	Win
Merriam-Webster® Dictionary (Franklin)	Dictionary that includes over 100,000 words and 300,000 definitions.	*www.franklin.com*	Commercial product	Palm	Win
NoahLite (ArsLexis)	Dictionary containing definitions of 122,000 words.	*www.arslexis.com*	Free product	Palm	Win
Palm Reader (Palm)	Electronic book reader. Pages may be bookmarked/annotated.	*www.peanutpress.com*	Free product	Palm/Windows CE	Win
RoadLingua	Shell program for a large variety of multilingual and specialty dictionaries.	*http://ppc.absoluteword.com*	Shareware	Palm/Windows CE	Mac/Win
Thesaurus/SpellCheck (DDH Software, Inc.)	Thesaurus contains 50,000 entries cross-referenced and indexed for speed.	*www.ddhsoftware.com/software.html?view=thesaurus*	Commercial product Free demo	Palm	Mac/Win
TrueTerm English/Spanish 2.6 (AlphaSoft)	A travel dictionary consisting of basic and supplementary vocabulary.	*www.pocketgear.com/software_detail.asp?id=898*	Free product	Windows CE	Win

Instructional/Curriculum

TITLE	DESCRIPTION	WEBSITE	TYPE	HANDHELD OPERATING SYSTEM	DESKTOP COMPONENT AVAILABLE
BugBand (MiniMusic)	Practice sight reading for piano or guitar and learn the letter names of notes.	*www.minimusic.com*	Commercial product Free demo	Palm	N/A
Cooties (Hi-Ce)	A virus-transfer simulation program.	*www.handheld.hice-dev.org/download.htm*	Free product	Palm	Mac/Win
Expedition ES (EddieSoft)	Surveying tool providing altitude, azimuth and distance measurements, and calculations.	*www.eddiesoft.com*	Shareware	Palm	N/A
Geney (Simon Fraser University EDGE Lab)	A collaborative problem-solving application to explore genetics.	*www.geney.net*	Free product	Palm	Mac/Win
ImagiMath (Imagiworks)	Includes ImagiGraph, a mathematics visualizer, ImagiCalc, a full-featured calculator, and ImagiSolve, a mathematical worksheet and equation solver.	*www.imagiworks.com*	Commercial product Free demo	Palm	Mac/Win
ImagiProbe (ImagiWorks)	Enables students to collect and analyze scientific data through data probes; includes software and Sensor Interface. (Sensors must be purchased separately.)	*www.imagiworks.com*	Commercial product	Palm	Mac/Win
Notepad (MiniMusic)	A music writer/editor/player.	*www.minimusic.com*	Commercial product Free demo	Palm	Mac/Win
PocketGraph	Displays data charts from PocketExcel or PocketWord.	*http://microsoft.handango.com/PlatformProductDetail.jsp?siteId=75&platformId=2&productType=2&productId=16135&sectionId=0&catalog=30*	Commercial product	Windows CE	Win
PowerOne Graph (Infinity Softworks)	Turns a handheld into a graphing calculator with 230 built-in math, science, and graphing functions.	*www.infinitysw.com/Products/powerOne_Graph.html*	Commercial product Free demo	Palm	Mac/Win
Word Wizard	Practice spelling, parts of speech, and vocabulary skills.	*www.pocketgear.com/software_detail.asp?id=2307*	Commercial product Free demo	Windows CE	Win

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Handheld Resources

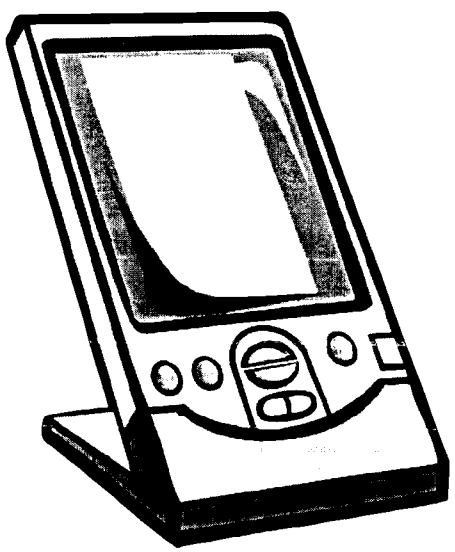
Hardware Manufacturers

Palm OS

- **Palm**
  www.palm.com
- **Handspring**
  www.handspring.com
- **Sony Clie**
  www.sonystyle.com/vaio/clie/index.shtml
- **Symbol**
  www.symbol.com/products/mobile_computers/mobile_computers.html

Windows CE/Pocket PC

- **Compaq—iPAQ Pocket PCs**
  www.compaq.com/products/handhelds/pocketpc/index.html
- **Casio**
  www.casio.com/personalpcs/section.cfm?section=19
- **Hewlett Packard**
  Jornada www.hp.com/jornada
- **Symbol**
  www.symbol.com/products/mobile_computers/mobile_computers.html



Software Resources

- **C|NET Downloads**—Shareware, freeware, and demo software for Palm and Windows CE/Pocket PC
  http://download.cnet.com/downloads/0-1726360.html?tag=stbc.gp
- **EuroCool**—Shareware, freeware, and demo software for Palm
  www.eurocool.com
- **Handango**—Shareware, freeware, demos, and commercial software for Palm and Windows CE/Pocket PC
  www.handango.com
- **Hi-Ce Learning in the Palm of Your Hand**—Free educational software for Palm
  www.handheld.hice-dev.org/download.htm
- **Palm Boulevard**—Shareware, freeware, and demo software for Palm
  http://palmblvd.com
- **Palm Education**—Educational software downloads and reviews for Palm
  www.palm.com/education
- **Palmgear**—Shareware, freeware, demos, and commercial software for Palm
  www.palmgear.com
- **PalmSpot**—Freeware, shareware, and commercial applications for Palm. Also sells hardware add-ons
  www.palmspot.com
- **Peanutpress**—Electronic books for Palm and Windows CE/Pocket PC
  www.peanutpress.com
- **Tucows**—Shareware, freeware, and demo software for Palm and Windows CE/Pocket PC
  www.tucows.com

Educational Hardware/ Software Resellers

The following companies accept educational purchase orders and offer academic pricing:

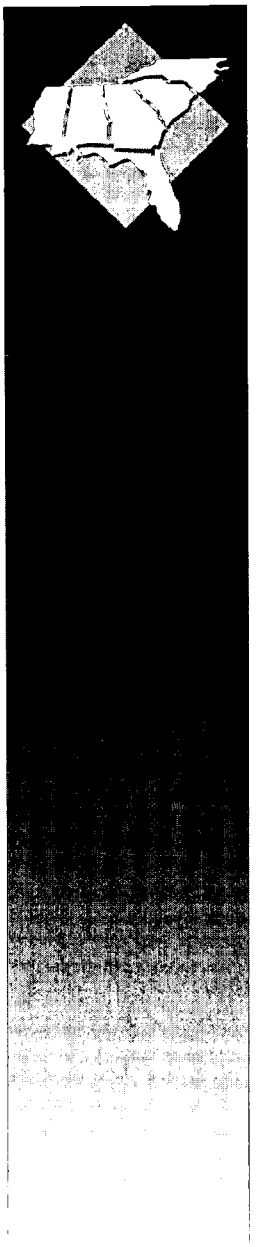
- **Educational Resources** *www.educationalresources.com*
- **K12 Handhelds** *www.k12handhelds.com*
- **MicroWarehouse** *www.microwarehouse.com*
- **Software Express** *www.swexpress.com*

Journals/Newsletters

- **Curriculum Administrators: Education in Hand**—A supplement to Curriculum Administrator, case studies in handheld educational uses *www.ca-magazine.com/SpecialReports/eih.asp*
- **Handheld Computing**—Printed monthly magazine for Palm devices *www.hhcmag.com*
- **InSync Online**—Palm, Inc.'s monthly electronic newsletter *www.insync-palm.com*
- **Mobile Computing**—Printed monthly magazine covering portable computers and handheld devices *www.mobilecomputing.com*
- **Palm Power Magazine**—An online magazine for Palm *www.palmpower.com*
- **Pocket PC**—Printed monthly magazine for Pocket PC devices *www.pocketpcmag.com*

News, Reviews, and Support

- **NearlyMobile**—Information dedicated to the new Palm user who is not technology savvy *www.nearlymobile.com*
- **Palm Infocenter.com**—The latest Palm OS industry news *www.palminfocenter.com*
- **Palm Knowledge Finder**—Online database of Palm tips and tricks, help, etc. *www.palm.com/support/kb/link_to_kb.html*
- **Palmtops/PDAs**—News, reviews, FAQs, and software links *http://palmtops.about.com*
- **PDA Constituent Group**—Discussion of issues and challenges concerning use of PDAs in higher education *www.educause.edu/memdir/cg/pda.html*
- **PDA Geek**—News, reviews, tips, and tricks *www.geek.com/pdageek/pdamain.htm*
- **PDABuzz**—News, reviews, forums, and other resources *www.PDABuzz.com*
- **PDAStreet**—The PDA Network of free downloads, reviews, news, and message boards for all the major handhelds *http://pdastreet.com*
- **pdaED.com**—News and reviews about handhelds in general. Bulletin boards specifically devoted to handhelds in education *www.pdaed.com*
- **Slashdot**—PDA news for nerds *http://slashdot.org/search.pl?topic=100*
- **ZDNet Shopper**—Comparison pricing for handhelds *http://zdnetshopper.cnet.com/shopping/0-11013-1401-0-0.html?tag=dir*



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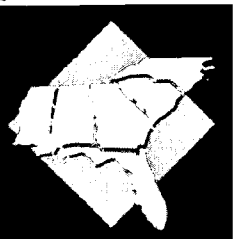

Glossary of Terms Used with Handheld Technologies

802.11b—See Wi-Fi

Archive Files—copies of deleted or purged handheld data that exist on the desktop computer and can be used to restore some deleted or purged data.

Beam—describes the use of infrared to transfer data from one handheld to another. With appropriate software, beaming can also be used to send a document from the handheld to an infrared-capable printer.

Bluetooth™—a wireless technology with a range of approximately 30-meter radius; works well for hard cable replacement.

Cradle—the stand that a handheld computer sits in to sync to a desktop computer. Used with some models as a battery charger.

eBook—an electronically formatted book, designed to be read from a computer, which may be a desktop computer, a handheld computer, or a specialized electronic book reading device.

Expansion Modules—items that are added on to a handheld device; these can be memory cards with software, such as large dictionaries or eBooks, or hardware items, such as digital cameras, GPSs, MP3 players, or science data probes.

GPS or Global Positioning System—a device that uses a network of satellites to determine precise positioning data; GPSs are used for navigation, mapping, surveying, and other applications where precise positioning information is needed.

Graffiti®—handwriting recognition software program that is the primary means of data input for the Palm OS.

Handheld Computer or Handheld—small computerized devices that fit into the palm of the hand and are designed for mobile computing.

MMC or Multimedia Card—a type of expansion card supported by the latest Palm handheld devices; these cards are very small, about the size of a postage stamp; see also "Secure Digital."

MP3—a format to facilitate the storage, management, promotion, and delivery of digital music.

OS or Operating System—software that is designed to manage hardware devices in order to enable applications and users to access it easily; examples of operating systems used for handheld computers include Windows CE® and the Palm OS®.

Palm Desktop®—software that runs on a desktop computer and can be used to enter, edit, or view data from a Palm OS handheld; data is updated and exchanged between the desktop and the handheld through the HotSync process.

Palm OS®—the operating system developed by Palm, Inc. for handheld devices; handheld devices produced by Palm, Handspring, IBM, Sony, and others use this operating system.

PAN—Personal Area Network.

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PDA or Personal Digital Assistant—a specific type of handheld device that serves the purpose of organizing personal information; these may include calendars, address books, notepads, calculators, and other useful tools.

PDB—a common Palm OS file extension that represents data or a database.

PIM or Personal Information Manager—a specific type of handheld device that serves the purpose of organizing personal information; these may include calendars, address books, notepads, calculators, and other useful tools.

Pocket PC—a generic term for a handheld computer running the Windows CE operating system; see "Windows CE" for more information.

PRC—a common Palm OS file extension that represents an application.

SD or Secure Digital—a type of expansion card supported by the latest Palm handheld devices; these cards use Flash technology and are writeable.

Springboard® Module—an expansion module that extends the functionality of a Handspring Visor handheld device; examples of Springboard modules include digital cameras, GPSs, and MP3 players.

Sync—short for synchronize.

Synchronization—The process by which the desktop computer and the handheld exchange and update information.

Ubiquitous Computing—computing that is omnipresent and is, or appears to be, everywhere all the time; may involve many different computing devices that are embedded in various devices or appliances and operate in the background.

USB or Universal Serial Bus—a type of connection to a desktop computer, which can be used to HotSync data; generally much faster than a standard serial connection.

Web Clipping—used to describe the editing or "clipping" of parts of Web pages to make them more readable on a handheld device. Companies such as AvantGo provide this service.

Wi-Fi (also known as 802.11b)—a wireless technology with a range of approximately 150–300 meters in radius and supports up to 11 megabit data rates, which makes it appropriate for wireless Internet access; this is the technology used by Apple AirPorts and Xircom's Wireless Ethernet modules.

Windows CE® OS—the operating system developed by the Microsoft Corporation for embedded systems and handheld devices; handheld devices produced by Compaq, Hewlett Packard, and others use this operating system.

Wireless—generally used to describe a device having intranet or Internet connectivity without wires; this can be achieved through wireless modem technology similar to a cellular phone or through wireless Ethernet cards using 802.11b technology.

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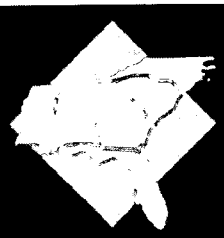

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SouthEast Initiatives Regional Technology in Education Consortium

Volume Five ◆ Number Three ◆ 2002

THIS ISSUE:
Evaluating Technology Initiatives

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SERVE
Improving Learning through Research & Development

Evaluating the Impact of Technology

When members of Congress passed the No Child Left Behind legislation, they called for sweeping changes in the way federal dollars are distributed for technology in schools. Gone are the Technology Literacy Challenge Fund (TLCF) and Technology Innovation Challenge Grants (TICG), which were consolidated into the Enhancing Education Through Technology (EETT) program. This new program, which is currently budgeted at $700 million a year, requires states to:

- Award half of the amount available to local education agencies (LEAs) through a formula based on Title I shares and half through a competitive process.
- Make competitive awards to high-need LEAs or partnerships that include a high-need LEA and at least one entity that can assist the high-need LEA to integrate technology effectively into classroom instruction.
- Use at least 25% of its formula allocation for high-quality professional development activities to prepare teachers to integrate technology into instruction.
- Require local applicants to describe how they would identify and promote strategies, based on relevant research, that integrate technology effectively into curricula and instruction.
- Develop accountability measures and a process for evaluating the extent to which the activities carried out with program funds are effective in supporting the integration of technology into curricula and instruction. (www.ed.gov/offices/OESE/esea/progsum/title2b.html)

Until now, states and districts have seldom been required to show the link between spending on technology initiatives and student achievement. The new legislation calls for educators not only to use research-based practices but also to provide evidence that teachers and students are actually using technology to improve student achievement. For example, state plans are expected to include program goals, performance indicators, performance objectives, and data sources for assessing the effectiveness of programs in terms of the teachers' and students' use of educational technology in support of academic achievement. In turn, states are requiring recipients of EETT funds to

(continued on page 2)

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(continued from page 1)
show that money spent on technology ultimately leads to improved student learning. As Barbara Teusink, Director of Technology for the South Carolina State Department of Education, explains:

> *The Ed Tech Grant program requires extensive accountability and evaluation procedures for use of technology funds. The No Child Left Behind Act is very timely for South Carolina as we begin to devise our 2003–2008 State Technology Plan. In correlation with Ed Tech guidelines, our plan will be performance-based and include measurable goals, objectives, indicators, and benchmarks for achievement at specific points throughout implementation. The evaluation component will add credibility to our technology programs and allow the State Department of Education to demonstrate the positive impact of professional development and technology integration in the core curriculum areas on student achievement.*

Because educators across the nation are, or soon will be, scrambling to find resources that will help them evaluate the effectiveness of their programs and the links to student achievement, this issue of *NewsWire* features articles about state and local accountability efforts, some things to think about when developing an evaluation plan, and resources for conducting useful evaluations. ◆

Tips for Writing an Evaluation Plan for a Technology Grant

by Elizabeth Byrom, Ed.D., SEIR◆TEC Principal Investigator

Ask anyone who has reviewed proposals for federal or state grants about the most important factor that determines which ones are funded and which ones are not, and they will invariably say the evaluation section. As Zucchini Dean of the Mississippi Department of Education says, "Most proposals contain very little about evaluation ... what they do say usually doesn't correlate with the goals they indicated in the proposal, and the focus is usually not on student achievement and teacher competency." There are dozens of reasons for these shortcomings, but one is that many of the educators who write the grant proposals have little or no experience in developing evaluation plans. With that in mind, SEIR◆TEC offers the following tips for writing an evaluation plan that will win approval:

1. Start with your project goals and objectives and work your way backwards to determine your evaluation questions, strategies, and methods. For example, if your goal is to improve student achievement, you need to define what you mean by "student achievement," and then identify the conditions that have to be in place in order for improvement to occur. Some essential conditions are as follows:
   - Curriculum, assessment, and technology use should be aligned.
   - Teachers and students have to use technology in meaningful ways.
   - Teachers must have ongoing, high-quality professional development that is directly related to what students are supposed to learn.
2. Ask good evaluation questions. Good questions will lead to the answers you need in order to determine whether your project makes a

difference in teaching and learning. Evaluation questions might ask:

- To what extent are teachers using what they learned in professional development activities?
- Do teachers and students have ready access to modern computers and the Internet?
- How effective is the project in identifying and addressing barriers to technology integration? (See article on *Evaluation Questions—Guiding Inquiry in Schools* on page 4 for additional information.)

3. Collect baseline data at the beginning of the project and ask the same questions over time. For example, if your project focuses on professional development, begin by determining teachers' current level of technology proficiency, use of technology, attitudes, interests, and needs. If you periodically ask them the same kinds of questions, and if their proficiency and use improve, you have some evidence of the cumulative effectiveness of the program.
4. Counting boxes isn't enough. It can be useful to know the number of computers available for student use or the student-to-computer ratio, but if you want to know whether technology is making a difference in teaching and learning, you have to examine how well and how much students and teachers are using it.
5. Look beyond standardized student achievement data. Standardized tests seldom measure the areas of learning where technology has been shown to have an impact, such as research skills, communication skills, quality of student work, dropout rate, and discipline referrals.
6. Surveys are no longer adequate as the single measure for determining the quality and impact of a technology project, mainly because self-reporting data are often unreliable. Consider using a variety of qualitative and quantitative measures, such as classroom observations, school portfolios, interviews, and focus groups. (See *Thinking Beyond Surveys* on page 21 for advantages and disadvantages of various measures.)
7. You don't have to develop evaluation tools; some excellent ones already exist. The U.S. Department of Education's book *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms* is a good place to start. (Available through the Database of the U.S. Department of Education Publications in ERIC or available at **www.ed.gov/pubs/pubdb.html**.) Also look at the websites of the Regional Technology in Education Consortia (RTEC), such as the High Plains RTEC's Profiler, the South Central RTEC's database of evaluation instruments, the North Central RTEC's enGauge, and SEIR◆TEC's technology integration progress gauge. (See *Tools for Evaluating Technology Projects and Programs* on page 26.)
8. Above all else, read the directions in the grant application package. If you don't meet all the funding agency's requirements for evaluation, the agency will be hard pressed to fund your project. This is especially true for the technology grants funded through the No Child Left Behind legislation because the states must provide data from the districts in order to show that the money is being well spent.

If you follow these tips and still feel uncertain about the quality of your evaluation plan, remember that it's okay to ask for help. Although there isn't an abundance of evaluators with experience in educational technology, you should be able to find an evaluator or researcher at a nearby college or university who can review your plan and offer suggestions. ◆

Evaluation Questions— Guiding Inquiry in Schools

by Ann Abeille, Director of Research and Evaluation, Learning Innovations at WestEd

Through the No Child Left Behind legislation, school and district practitioners are being asked to become more involved in the evaluation of the effectiveness of their schools' efforts and progress. Many practitioners are short on time, funding, and evaluation experience. However, educators can maximize their learning from this work by building their evaluation around clearly articulated evaluation questions.

The critical guidance for evaluation work, just as in school-based action research, is identification, use, and reflection on essential questions. These questions drive the learning, and evaluation is about learning:

- Learning how students and teachers are using technology
- Learning what kinds of professional development and support are making a difference in classroom practice
- Learning how the infusion of technology is changing student approaches to learning, characteristics of student products, and student achievement in curricular areas

As practitioners engage in evaluation work, whether involved in a formal evaluation (perhaps supporting the work of outside evaluators) or undertaking an informal examination of a school initiative, they need to consider the following aspects of evaluation questions.

Question Identification

Identify the overarching questions that you want to answer and why. First of all, what do you and the people in your school want to learn from this evaluation work? If you are working with grant funds, what do the funders want to learn? For example, if your school or district has received a grant to engage faculty, students, and community members to use a variety of technologies to enhance science and mathematics learning through a community-based environmental study, what would you want to learn from your evaluation efforts? Some of your evaluation questions might be:

- How has the funding from the grant actually been used? What training was provided to students and faculty in using the various technologies? What was the perceived quality of the training? How many students, faculty, and community members were involved in the training?
- How did students and faculty use technologies in the environmental study? What areas of mathematics did students explore? To what extent did students engage in mathematics and science inquiry? What role did technology play in this inquiry?
- What mathematical concepts or skills did students gain through this project? To what extent did

students demonstrate mathematics and science inquiry skills?

- As this program is instituted and continued, are there notable increases in the percentage of students meeting grade-level-appropriate technology standards? Is there improvement in student achievement in the areas of mathematics focused upon in the project?
- How have student, faculty, and community attitudes changed through this project (e.g., attitudes toward mathematics and science, the use of technology, or the environment)?

Identifying and prioritizing these questions is the first step toward meaningful evaluation and essential learning for your school.

Matching Methods to Questions

It is essential to remember that the identification of evaluation questions dictates the choice of evaluation methods. Practitioners need to ensure that the data-gathering methods used will result in answers to the identified questions.

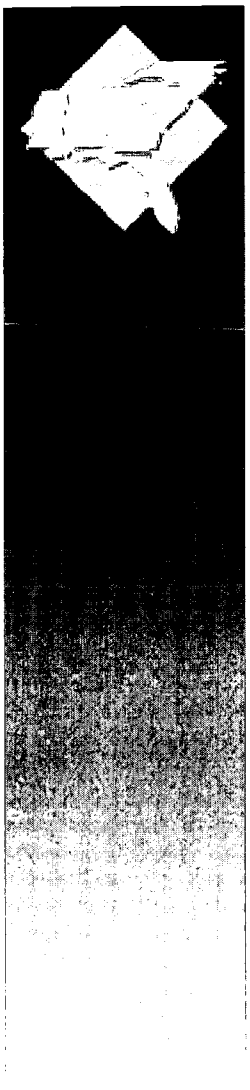
Using methods such as questionnaires, interviews, and focus groups makes perfect sense when you wish to determine changes in attitudes (e.g., attitudes toward technology use). However, classroom observations become the essential method (with interviews or questionnaires providing additional information) to gain useful data about the use of technologies or the engagement of students in mathematics and science inquiry.

Although teacher interviews may give some insights into student learning and changes in student achievement of technology standards, an analysis of student products will more directly answer such an evaluation question. If the development of certain mathematics learning has been targeted within this project, an appropriate method may be the tracking of changes over time in teacher-designed assessments or selected sections of standardized tests.

It is essential to choose methods for your evaluation that will yield appropriate data for answering your top-priority questions.

Reflections on Evaluation Questions

Finally, it is critical, when the data are in and analyzed, to return to the evaluation questions and the results in order to determine the implications for your future work. For instance, perhaps you found that although the quality and reach of the technology-related professional development was excellent, too much time elapsed between that learning and the actual use of the technology in the environmental study, so time and energy had to be wasted on additional training. Or perhaps your classroom observations indicated that although use of graphing calculators was to be an essential component of the environmental project, the use was negligible. What if after three years of similar project work, the targeted areas for improvement in mathematics achievement showed no improvement? These findings would certainly lead you to strategic changes in your work. ◆



Lessons Learned from Action Research: Evaluation from the Trenches

by Zelia Frick, Supervisor of Instructional Technology, Guilford County Schools (North Carolina)

"Your grant has been funded!" These words are music to the ears of applicants who work diligently to acquire much-needed funding for technology. Recipients eagerly await the arrival of new equipment, software, and training. Then comes the process of assessment and evaluation. How do we know the technology placed in classrooms improves the way teachers teach and the way students learn? What evaluation instruments will we use, and what questions will we ask?

As Supervisor of Instructional Technology for Guilford County Schools in Greensboro, North Carolina, I faced the challenge of assessment and evaluation in 1998 upon receiving a Technology Literacy Challenge Fund (TLCF) grant entitled Project Read/Write. The project's goal was "to improve student academic achievement in reading and writing through the integration of technology." The grant provided ten underachieving third-grade classrooms with computers, an inkjet printer, a collection of reading/writing software, and on-site instructional support. Participating teachers were required to attend all staff-development sessions and allow students to use the technology a minimum of 20 minutes, three times each week.

Like most technology leaders, I had no expertise in research and evaluation even though I had been working in the "trenches" of instructional technology for many years. I thought implementation and evaluation of Project Read/Write would be quite simple: 1) participating teachers would select the software, 2) equipment would be purchased, 3) teachers would be trained, and 4) student end-of-grade reading scores would improve. Experience is a great teacher.

After four years involved in "action research," I have learned that assessment and evaluation can be challenging and time consuming. Hopefully, you can learn from my experiences.

One of the most valuable resources we used to evaluate our project was the Evaluation chapter in SEIR◆TEC's *Planning into Practice* (www.seirtec.org/publications). This practical guide assisted me in understanding important terms and in creating the crosswalk shown in the following chart that delineates the evaluation questions, methods of data collection, and data analysis. Our project evaluation focused on answering questions related to accountability, quality, impact, sustainability, and lessons learned.

As we implemented Project Read/Write, we learned the importance and value of determining how well strategies are working and making adjustments when necessary. Sometimes the adjustments were made to project activities and sometimes to evaluation strategies.

Accountability: How do we know the project is making a positive impact on student achievement?

Year 1 Question: Did a higher percentage of students receive an "on-grade-level" score than in previous years? Using North Carolina third-grade end-of-grade (EOG) reading scores, a bar graph was created charting school EOG scores for seven years. Two of the three schools achieved their highest scores in seven years, and the third school achieved its second-highest scores in seven years. The data, however, did not address other factors that may have affected these high scores and were not compared to a control group.

(continued on page 8)

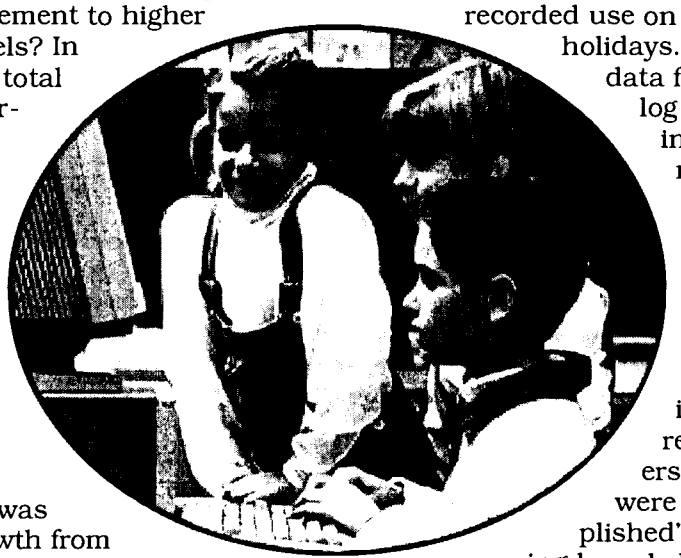
Project Goal: To improve student achievement in reading and writing through the integration of technology.

Question	Instrument	Collection Period	Pluses	Deltas
Accountability: Is the project making a positive impact on student achievement?				
Did a higher percentage of students score Level III/IV than previous years?	Bar Graph: Percentage of students scored Levels III/IV compared with previous years	North Carolina third-grade EOG reading scores	Uses validated data Identifies trends Has potential for individual classroom and student analysis	Data do not show longitudinal growth for individuals Graphs show data by school—not individual or classroom growth Does not identify other factors impacting test scores
Was student achievement higher for the project group or the control group?	Bar Graph: Compare scale score growth (pre-test to End-of-Grade) to control group			
Did students in the project have higher scale score gains and greater movement to higher achievement levels?	Table: Compare End-of-Grade scores to pre-project scores Table: Comparison of growth within each reading level			
Quality: How well are we implementing program activities and strategies?				
Is student use meeting the minimal requirements?	Student logs	Every two months	Teacher accountability Uses tracking Student records	Reliability of data Time intensive Personnel demands
Is student use appropriate and accurate?	On-site visits Forms and checklist	Often as possible	Data are reliable Identifies problems Support for teacher	Time consuming Personnel needed
Are teachers having any technical problems?	Web-based tech help Tech support forms	Collected each training session	Report of technical problems	
Has professional development been effective?	Workshop evaluation form	Collected each training session	Immediate feedback Identifies areas for improvement	Reliability of self-evaluation Quality of questions
Are students effectively using the project?	Formal observation	Six observations per sample participant	Validates student logs	Time consuming Training observers Validation of instrument
Impact: Is the project making a difference for students?				
Do students think their reading and writing skills have improved?	Student survey	End of the year	Feedback on student attitude and perception	Time to collect Time to interpret
Do teachers think the project has helped improve student achievement?	Teacher survey	End of the year	Feedback on teacher attitude and perception	Time to collect Time to interpret
Is there evidence of improved writing skills?	Writing samples	Fall and spring	Evidence to validate improvement in writing	Time to develop rubric Training scorers Time to score and analyze
Sustainability: What needs to be in place for sustaining the project's goal?				
Will hardware and software remain adequate?	Inventory sheets	Beginning and ending of year	Maintains location of resources	Time and accuracy

(continued from page 6)

Year 2 Question: Was student achievement higher for the project group or the control group? Three additional schools participated in Project Read/Write the second year. Fifteen schools were on the waiting list to receive funding for the project, and they became the control group. During the second year, scores from the project schools were compared to scores from the control group. Project Read/Write schools displayed greater gains.

Year 3 Question: Did students in the project have higher-scale score gains and greater movement to higher achievement levels? In the third year, a total of 21 schools participated in the project. Third-grade pretest reading scores were compared to the EOG scores, and average scale score growth was charted for each school. Growth from the pre-project year was compared to growth from the first year of the project. Data indicated there was a definite trend toward higher achievement levels with Project Read/Write schools.



Quality: How well are the program activities and strategies being implemented? Is student use meeting the minimal requirement?

Student log sheets were developed to assess the quality of implementation. During Year 1, teachers had students record their names on a daily log sheet when using the computer. However, accounting for student software use in this fashion proved to be rather problematic. In Year 2, a yearlong calendar was created for each student so that he or she could record the title of the software used on the appropriate calendar day. Teachers were not required to submit their calendars until the end of school, so teachers not using the technology slipped by unnoticed until administrators examined the data and discovered there was a problem. Finally in Year 3, a valid instrument for assessing student use was developed. A two-month calendar was created for each student, and data were collected every two months. Data were entered into a database, and classroom reports were printed and sent to each school's administration. The new process made teachers accountable and provided excellent data for assessing the project's implementation. Some students were so dedicated that they recorded use on weekends and holidays. Conclusion—data from student log sheets was invaluable but not always reliable.

Workshop evaluation forms are a necessity, but self-evaluation is not always reliable. Teachers indicated they were "highly accomplished" in the working knowledge of software, but informal observations indicated otherwise. Teachers reported that they had acquired knowledge in the workshop but, upon returning to the classroom, forgot a lot of details and could not remember how to start.

Site visits are imperative to ensure proper implementation. Site visit reports proved to be especially valuable as they provided reliable data about technical and/or instructional problems within the classrooms. Formal observations validated student logs and supplied compelling evidence of student use. Trained personnel are needed to validate an observation instrument and complete the observations, but it's worth the effort to validate proper implementation. Once a problem is identified, instructional support can be readied for the teacher.

Impact: Is the project making a difference for students? Do students think their reading and writing skills have improved?

Answers to these questions were obtained by having students complete a survey at the beginning and end of the year. Data from each survey were reviewed to see if student attitudes had improved toward reading. Participating teachers from Year 1 created a student survey that included the following statements:

1. When I have free time, I choose to read
   a) never, b) sometimes, c) always
2. Reading makes me feel
   a) happy, b) no feeling, c) sad

Expectations were that students would change their attitudes toward reading in a positive direction, but when surveys were collected at the end of the year, student feelings had reversed. Student interviews revealed that they were excited about reading in the fall and spent a lot of time reading. However, after the winter months, students were ready to spend time outdoors, and their interests were redirected toward other activities. The revised survey has proven to be more effective and is completed only after end-of-grade tests. It includes the following questions:

1. Are you a better reader now than you were at the beginning of the school year? (Yes/No)
2. Do you enjoy reading more now than you did at the beginning of the school year? (Yes/No)

Asking the "right" question is critical to effective evaluation.

Sustainability: What needs to be in place for sustaining the project's goal? Are all elements in place?

Sustainability appeared to be a non-issue for Project Read/Write. All hardware with appropriate software was in place and working. Project Read/Write would help students for many years. All teachers had been trained, and student use looked great. But had all teachers really been trained?

Seventy-eight classrooms were participating in the project by Year 4, but there were 42 new teachers. Of the original ten classrooms that began in 1998, only two teachers remained. How could this happen? Teacher turnover is a major problem for underachieving schools. Turnover makes it difficult to bring about change when you consider that it takes an average of 4–5 years for most teachers to become proficient enough with technology to use computers fluidly and effectively. To sustain Project Read/Write, we must meet the challenge that teacher turnover creates every year.

Looking back, I can safely say that we learned a lot of valuable lessons about the implementation and evaluation of technology projects:

- An evaluation model needs to be defined at the beginning of the project.
- So many factors impact student achievement that change attributed to technology use is difficult to measure.
- Self-evaluation data are not always reliable.
- When possible, use electronic surveys rather than paper and pencil.
- Although creating quality surveys with appropriate questions is a challenge, it is crucial to effective evaluation.
- Software with built-in management systems provides reliable documentation of student use.
- It takes multiple years for the effective implementation of projects to impact student achievement.
- Site-visits are a necessity; they provide reliable information and support for teachers.
- Measuring the quality and impact of a technology program takes time and may require additional personnel.

If you're assessing and evaluating a technology program, the SEIR◆TEC model will provide you valuable information to measure the program's effectiveness. You will learn a lot—I guarantee it. ◆

Alabama Indicators for Measuring Progress

by Melinda Maddox, Ed.D., Coordinator, Office of Technology Initiatives, Alabama Department of Education

Alabama took a bold step when it was time to revise our state technology plan in 2000–2001. We shifted from an emphasis on guidelines and recommendations for installing hardware and networks to a framework based on a set of indicators and benchmarks for measuring outcomes. The new plan, IMPACT, which stands for Indicators for Measuring Progress in Advancing Classroom Technology, establishes essential conditions—such as funding, support, and training—necessary to use technology, but its primary focus is using technology to improve student learning in Alabama's schools.

Alabama IMPACT provides a set of progress indicators, measures, and a target timeline (2002–2005) for integrating technology across the curriculum. Examples of sources of evidence/data-collection methods are provided to help schools and school systems assess their progress toward meeting the benchmarks established in this document. The indicators address the six objective areas of learning, technology integration, professional development, environment, access, and cost of ownership. Local schools and school systems are using these indicators and benchmarks to design their technology plans for technology integration, to make decisions, and to create policies to guide the direction of technology.

Development of IMPACT

The document was written from the ground up with extensive input from stakeholders throughout the state. This process gained us buy-in from the beginning and a gradual growth in understanding of the use of indicators and benchmarks for technology planning prior to the rollout of the plan. Over the course of one-and-one-half years, we convened four different task force groups and held several state agency staff work sessions.

- Members of the first focus group wrote goals and objectives. Their task was completed over a two-day period.
- The Office of Technology Initiatives' staff further defined the process and framework for the plan and established the major categories as goal, objectives, rationale, indicators, benchmarks, sources of evidence, and strategies.
- A second focus group developed the document with indicators, benchmarks, and sources of evidence. This group was the main writing team and worked about six months to complete its tasks. The members gathered input from district technology coordinators, superintendents, and other technology leaders at the annual Alabama Educational Technology Association (AETA) Fall Symposium. The second focus group used this input to finalize the indicators, benchmarks, and sources of evidence.
- A third focus group wrote the state technology plan requirements for district and school technology plans.
- The final focus group wrote state strategies. This group represented all areas including public, private, and business and industry leaders, as well as members from all of the three previous focus groups.

IMPACT Example

The IMPACT document reflects the input from all of the focus groups and state teams. For each objective, we used the same format. The goal—to improve learning through the use of

technology—is listed first, followed by a rationale for the objective, indicators, benchmarks, sources of evidence, and the data-collection methods, as shown in the following table.

Learning Objective: Encourage learning that is relevant and authentic through the use of technology.

Rationale: In classrooms where technology is used effectively as a tool, students are more autonomous, collaborative, and reflective than in classrooms where technology is used only for drill and practice. Technology engages students in real-life applications of academics and encourages them to be more independent and responsible for their own learning. In a knowledge-based society, it is important that students have the self-confidence, knowledge base, technology fluency, and cooperative skills that will enable them to continue learning throughout their lives. Technology facilitates the study of the academics within the context of meaningful and authentic applications.

Indicators:	Benchmarks (Target year 2005):	Examples of sources of evidence/data-collection methods:
1a. Learners develop, model, and assess age-appropriate projects that are relevant and authentic.	1.1 All students use technology to complete inquiry-based learning projects that reflect personal significance and/or societal importance. 1.2 All teachers assess student-based projects using well-designed scoring guides. 1.3 All administrators assess teachers' ability to implement learner-centered classrooms.	Surveys Student products Lesson plans Observation Video samples Standards-based scoring guides Personnel Evaluation System (PEPE) Electronic usage data Online assessments
1b. Learners' work incorporates real-world applications of technology.	1.4 All students, teachers, and administrators use productivity tools such as spreadsheets, databases, presentation software, and Internet resources to solve problems and make decisions.	Surveys Student products Lesson plans Observation
1c. Learners use technology resources to gather, store, reshape, analyze, and communicate information.	1.5 Student products contain a data analysis component using productivity tools such as spreadsheets, graphing packages, and/or databases. 1.6 All teachers collect and analyze data to make adjustments to their operational curriculum (i.e., classroom). 1.7 All administrators collect and analyze data to make decisions that affect the overall operation of the school.	Surveys Student projects Lesson plans Observation Structured interviews Online assessments Electronic usage data
1d. Learners use technology resources to access quality information from numerous sources.	1.8 All students and teachers select appropriate technology-based resources such as the Internet, real-time probes, hand-held devices, and the Alabama Virtual Library (AVL) based on intended purpose.	Lesson plans Student projects Observation Personnel Evaluation System (PEPE)
1e. Learners are proficient in technology and information literacy standards.	1.9 All students and teachers use technology during the instructional day based on the local, state, and national standards.	Surveys Lesson plans Observation Student projects

Terms	Definition
Learners	Students, teachers, non-certificated staff, administrators, parents, community members, business owners, and citizens
Goal	The final outcome desired
Rationale	Reason for the objective
Objectives	Broad actions intended to fulfill the goal or outcome
Indicators	Attributes or activities that are necessary to fulfill the objective and overall goal (These are readily converted to benchmarks.)
Benchmarks	Specific, observable, measurable actions or behaviors; used to gauge progress over time
Sources of Evidence/ Data-Collection Methods	Physical items, such as plans, reports, observations, etc., that enable the researcher to document fulfillment of objectives
Strategies	Steps or actions that will be taken to accomplish the objective

Reactions from the Field

By the time we introduced the IMPACT document and the concept of using technology integration indicators and meeting benchmarks to the local educators, they were old news. Educators had heard so much about the new framework that we received very positive reactions. Two of our local technology educators expressed an understanding of the value gained from using indicators to measure progress and the acceptance of the IMPACT framework as follows:

> *The Alabama State Department of Education's Office of Technology Initiatives has provided important leadership and guidance to local school districts through the IMPACT document that was produced to assist in the development of district technology plans. IMPACT provided clearly defined benchmarks and indicators and explained scientifically-based research as applied to the use of technology in the educational process. The clearly defined goal and objectives in six domains focused limited funding toward areas that would have the greatest effect on student learning. Local district technology coordinators have been able to develop technology plans that meet the needs of students and teachers as a result of IMPACT. The use of indicators and benchmarks in developing an individual school and school district technology plan are paramount to progress being*

made toward the stated goal. School leaders and classroom teachers who understand the ultimate goal and understand the steps that have been established to achieve it are more likely to enthusiastically embrace the process and significantly contribute to its achievement. The Alabama Department of Education's Office of Technology Initiatives is to be commended for its leadership in providing guidance, direction, and support that is on the forefront of education reform.

—Steve Sumners,
District Technology Coordinator,
Cherokee County School District

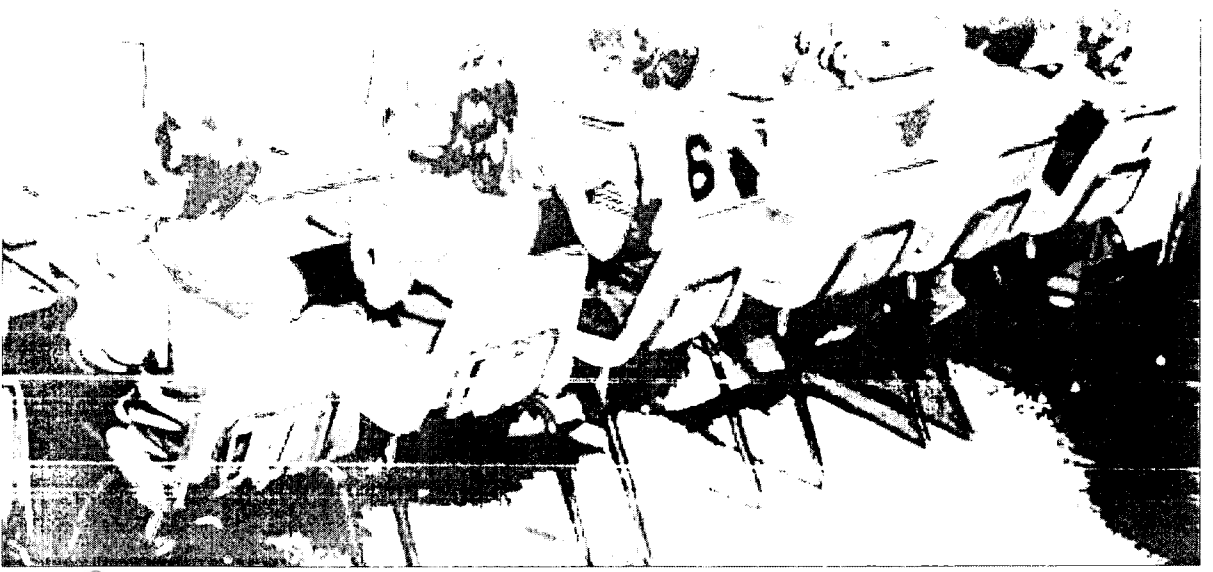
Having state-developed benchmarks and indicators for the benchmarks helped our system develop its technology plan. IMPACT covered all the areas that we wanted to address, as a system. However, the goals and objectives for the state plan were general in nature. Working with the benchmarks and the indicators made understanding what would be required under these broader goals and objectives easy to understand. They gave concrete examples to follow. That made developing our new technology plan both easy and productive.

—David Crouse, Ed.D.,
Technology Coordinator,
Roanoke City Schools

Current Status

Statewide technology assessment instruments are being developed to measure state progress in achieving the benchmarks outlined in IMPACT. Currently, local school districts are required to align local plans with IMPACT and to evaluate and report progress toward achieving benchmarks on a yearly basis. The local school districts are writing their yearly technology plans and reporting progress toward achieving their benchmarks with an online process. At the state level, the indicators from IMPACT were the basis of our state application for the Enhancing Education Through Technology application for federal funds for educational technology.

IMPACT gives us a strong focus on where we need to go in the next few years in educational technology in Alabama and will help the state better measure progress in local schools. It is a statewide, long-range, strategic educational technology plan affecting every district and every school. By having documented outcomes based on the state and local indicators and benchmarks for educational technology, we already have and will continue to receive evidence of the success in using technology to impact teaching and learning. Taking the bold step to not revise but to redesign our state technology plan was a risk, but a risk well worth taking. ◆



State Guidelines for Enhancing Education Through Technology (EETT) Projects

Over the past few months, technology leaders in state education agencies (SEAs) have been putting together grant application packages for competitive Enhancing Education Through Technology grants. Tammy Mainwaring, an Education Associate with the Professional Development and Instructional Technology Office of the South Carolina Department of Education, has graciously agreed to share the guidelines and sample evaluation matrix that she and her colleagues have developed as a resource for educators in their state as they prepare, implement, and evaluate their technology projects. The original version has been modified slightly to make it generally applicable throughout the region.

Step 1: Conduct a needs assessment and collect baseline data. The baseline data should provide information at the start of a program. The data will be used to set goals and benchmarks to determine the amount of change you desire throughout the stages of your project. Baseline data are collected before the beginning of the project. There are many sources of data that can be collected and utilized effectively when creating your goals, benchmarks, and expected outcomes. Examples of data that can be used include surveys, interviews, school records, standardized test scores, observations, technology documents, and portfolios.

Step 2: Analyze your technology needs through the baseline data and create your overall program goals. Limit your program goals to a minimum of three and a maximum of five. Your goals will be the overall statements of expectation arising from the purposes of your technology program. Each goal should be accompanied by a projected completion date.

Step 3: Dissect each goal and determine realistic strategies that will lead to the achievement of the overall goal. Some goals will require more strategies than others. This section outlines your step-by-step process for reaching your end-of-program expected outcomes. It also gives you a guide for staying on track with your project.

Step 4: Develop indicators of achievement. The indicators will be more specific than your strategies and will provide a measurement, such as a certain percentage of teachers, the number of computers, etc. Setting achievable indicators will be a key to the successful completion of your project.

Step 5: Set benchmarks and target dates that will define the progress the district expects to make at specified points in time with respect to each indicator. These benchmarks should show the process for ongoing evaluation of the technology project.

Step 6: List the data sources you will use to continuously measure progress. These data will be used in your project reports.

Step 7: Describe your expected outcomes of each goal. Student achievement and teacher technology proficiency should be integral to your expected outcomes.

Step 8: Prepare your report of results, findings, and recommendations at the completion of your project.

Project Goal *(Should be linked to student achievement, teacher proficiency, equity of access, and accountability.)*	Goal 1: Teacher Proficiency By their next recertification period beginning in 2005, teachers will be deemed technologically proficient in accordance with district standards. Teachers must renew this proficiency each recertification cycle thereafter.
Sources of Baseline Data *(These data will be used to paint a current picture of your district prior to project implementation.)*	Surveys Self-assessments Observations Portfolios District teacher proficiency assurance forms *(Data for this goal should assist you in determining the percentage of teachers who are now considered technology proficient, keep portfolios, and participate in professional development opportunities.)*
Strategies for Achieving the Goal *(List relevant strategies to help you reach your goal. These must be strategies you can measure and prove have been implemented.)*	1. Technology leaders will be assigned to each school to train colleagues and guide novices in the use of technology integration. 2. A needs assessment will be given to teachers to determine the professional development that must be offered on different levels of proficiency. Courses will be designed and offered to accommodate the faculty as they move from novice learners to expert integrators of technology into the curriculum to teach the South Carolina state standards. 3. Teachers will maintain electronic portfolios that will document proficiency using a technology skills rubric.
Indicators *(These statements must be measurable using terms such as a percentage of teachers or the number of computers, etc.)*	1.1—By September 2003, one technology leader will be operating in each school. 1.2—By September 2003, 30% of teachers will demonstrate use of technology integration lessons evidenced through materials in student and teacher portfolios. *(More than one indicator and benchmark can be given for each strategy.)*
Target Benchmarks *(These define the progress you want to make at specified points in time with respect to each indicator.)*	1.1.1—The percentage of technology proficient teachers in the district will increase from 30% in 2002 to 40% in 2003. 1.1.2—The percentage of technology proficient teachers will increase from 40% in 2003 to 50% in 2004. *(You can move through the grant month-by-month, semester-by-semester, year-by-year, etc.)*
Proposed Process for Ongoing Evaluation *(Each district must have reliable data. Districts should be ready to share the data with the technical assistance teams.)*	Annual submission of teacher technology proficiency assurance forms to the State Department of Education Random monthly documented classroom walkthroughs and evaluations Random monthly examinations for Teacher Technology portfolios to include lesson plans, professional activities, student work, etc. Record of attendance and completion levels of teacher professional development courses Teacher self-assessment instruments to be completed biannually
Data Sources to be Used for Ongoing Evaluation and End-of–Program Reports *(Examples include test scores, graduation rates, portfolios, observations, surveys, and interviews.)*	Annual teacher technology proficiency assurance forms Classroom observation walkthrough documentation Notes transcribed regarding the quality and content of teacher technology portfolios Biannual teacher self-assessments Documented records of individual teacher professional development activities
Desired Outcomes *(Should be linked to student achievement, teacher proficiency, equity of access, and accountability.)*	By the year 2009, all teachers will be technologically proficient in integrating technology as a tool to increase student achievement to teach to the South Carolina state standards.

TAGLIT: A Tool for Measuring a Project's Results

by Katherine Tankson, Director of the Mississippi TASL Grant, and Betty Lou Pigg, Information Technology Planner with the Mississippi Department of Education

Note: The Taking a Good Look at Instructional Technology (TAGLIT) assessment tool is an element of each state's Bill and Melinda Gates Technology Leadership grant. For further information on the use of TAGLIT, contact the administrator for your state's Gates Technology Leadership grant.

How can educators make informed decisions that result in successful uses of technology for teaching and learning? How can they know if their decisions are having an impact? To many administrators and school technology leaders, these questions present major challenges. However, a growing number of educators have discovered a solution. They are using TAGLIT (Taking a Good Look at Instructional Technology) to determine the perception of technology use and impact at their schools and to measure changes resulting from technology projects and initiatives. Mississippi administrators are among those using TAGLIT to evaluate technology initiatives.

TAGLIT is an online suite of self-assessment tools for school leaders, teachers, and students that provides measurements of progress over time (www.taglit.org). Dr. Sheila Cory and Jennifer Peterson developed the tools for participants in the Principals as Technology Leaders Program offered by the North Carolina Principals Executive Program. The Web version was initially supported by the BellSouth Foundation and is currently Web-enabled by SAS with support from the Bill and Melinda Gates Foundation. As a result of this support, many educators are aware of and have used the TAGLIT tools. Why? Every state has a Gates Foundation state challenge grant for technology leaders, and a requirement of the grant is that all participants—mostly principals—in the grant must complete the TAGLIT assessment for school leaders. In turn, the school leaders are to have their teachers complete the teacher tool, and they have the option to have their students complete the student tool.

The Mississippi Department of Education was one of the earliest users of TAGLIT as a component of the Gates Foundation challenge grant. The grant established the Technology Academy for School Leaders (TASL). Participants in the week-long academy and follow-up sessions have discovered that TAGLIT data help them accomplish the TASL goals:

- To facilitate the integration of technology in the total district/school environment.
- To enhance the principals' and superintendents' technology leadership skills in support of teaching, learning, and data-driven decision making.
- To facilitate the creation of learning environments that empower staff to infuse technology into teaching and learning.
- To assist school leaders in the definition of local issues and the development of solutions and strategies to address them.

In the Mississippi TASL project, the suite of assessments is explained to participants during the academy and during the Day 1 Follow-up Activity conducted three months after the academy. Participants are trained to interpret the Data Summary report and generate their Final Report. Each participating principal in TASL is responsible for monitoring the administration of TAGLIT to 100% of the instructional staff and 50% or higher of the student population in grades 3–12 and for completing the leader's assessment for his/her assigned school.

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TAGLIT generates valuable data for administrators about ways technology is being used in their schools. Administrators did not previously have a means to collect and analyze this type of data, especially in the quantity that TAGLIT provides. School leaders answer 69 questions on technology planning, hardware, software, instructional and technical support, budgets, policies, and community involvement. Teachers answer questions (61 for elementary teachers and 71 for middle and high school teachers) on skills, frequency of use, how technology affects classroom activities, technology planning, hardware, software, and instructional and technical support. Students complete questions on skills, frequency of use, and how technology affects classroom activities—15 questions for elementary school students and 53 for middle and high school students. With this quantity and range of data, school administrators who administer the assessments periodically have a means of measuring progress of technology use and impact at their schools.

For our administrators, TAGLIT has played an integral part in helping them better understand the following:

- The role of technology in enhancing teaching and learning.
- The present status of teachers' and students' technology skills and use.
- School technology planning, budgeting, and professional development needs.
- The availability of emerging technologies in the schools.

The results of the TAGLIT assessments have been an eye opener for many of the TASL participants. One of the statements on the Day 2 Follow-up Activity (conducted nine months after an academy) was "The TAGLIT information provided my district/schools was valuable information that has impacted our professional development program and technology integration." On a scale of 1 to 5, with 5—Strongly Agree, 4—Agree, and 1—Strongly Disagree, 78% of the participants rated this question a 5 and 22% a 4. Comments made by some of the participants included:

- "The TAGLIT results identified technology training as our number one professional development need."
- "Significant training is needed in getting our teachers ready to effectively integrate technology into classroom instruction."
- "More time must be spent in training our teachers so that they can be successful in preparing our students for this technological age."

Many of the participating principals have used the TAGLIT assessment results to document the considerable need for training in the area of technology use and integration. As a result of their analysis of the data, they have scheduled the Phase Technology Trainings offered through the Mississippi Office of Educational Technology and the MarcoPolo Training (online classroom technology integration). Additionally, principals are also sending teachers to technology training sessions to become school-site technology trainers and placing more emphasis on technology-based professional development. Many are encouraging teachers to either take courses online or participate in interactive video (distance learning) course offerings to receive advanced degrees, licensure renewal, and/or technology professional growth.

Increased emphasis on technology professional development is not the only result of having the TAGLIT data available. At the state level, we have used it as part of our project evaluation and to help improve the activities of the TASL project. Certainly the data will be useful for future grant proposal writing and for state program policy development.

Whether at the school level or with the state project, TAGLIT, as a tool for measuring a project's results, is making a difference in the Mississippi school districts. ◆

Steps in Evaluating a School or District Technology Program

by Jeff Sun, Sun Associates

Sun Associates—an educational consulting firm and frequent SEIR◆TEC collaborator—has worked with a number of school districts to develop and facilitate formative evaluations of technology's impact on teaching and learning. Over the past several years, we have worked with districts in Kentucky, New York, Massachusetts, and Michigan to create research-based formative evaluations that are used to measure a district's progress toward meeting its own strategic goals for technology implementation and integration. In most cases, our client districts have taken the developed evaluation procedures and have applied them annually to support a formative approach to assessing their technology efforts.

The process most often employed with districts consists of three interrelated stages: evaluation framing, data collection, and reporting.

Stage 1—Evaluation framing, committee orientation, and rubric development

Just as with technology planning, technology evaluation is a committee-driven process. Therefore, the first step in this process is for the district to appoint an evaluation committee composed of district stakeholders such as teachers, administrators, parents, board members, and students. The exact composition varies and reflects the values and priorities of the district that is conducting the evaluation. Once the committee is selected, we facilitate a full day of training for the committee. During this training, the entire evaluation process is overviewed, milestones are set, and initial responsibilities are assigned.

After its initial day of training, the committee meets for another two days to develop the district's key evaluation questions and to create indicators for those questions. While the developed indicators are always tied directly to the district's own strategic vision and goals for technology, we also key the indicators to standards and frameworks such as the National Educational Technology Standards (NETS) for students and Milken's Seven Dimensions, as well as local and state curriculum frameworks.

In most cases, the evaluation committee breaks into subcommittees to develop indicators for individual questions. Once these indicators have been developed and approved by the district committee, we organize all of this work into a set of indicator rubrics. These rubrics (see www.sun-associates.com/eval/sample.html for examples) form the basis for the district's evaluation work.

Stage 2—Data collection and analysis

Data collection is designed in response to the district's evaluation rubrics. Data are gathered that will enable the district to answer the evaluation questions and score its performance on its evaluation rubrics. Typically, a data-collection effort will include:

- Surveys of teachers, administrators, students, and/or community members. Unique surveys are created for each target population and are based on the data-collection needs described in the district's rubrics.
- Focus group interviews of teachers, administrators, students, technology staff, and other groups of key participants in the district's educational and technology efforts.
- Classroom observations. External evaluators will typically spend time in schools and classrooms throughout the district. The evaluators not

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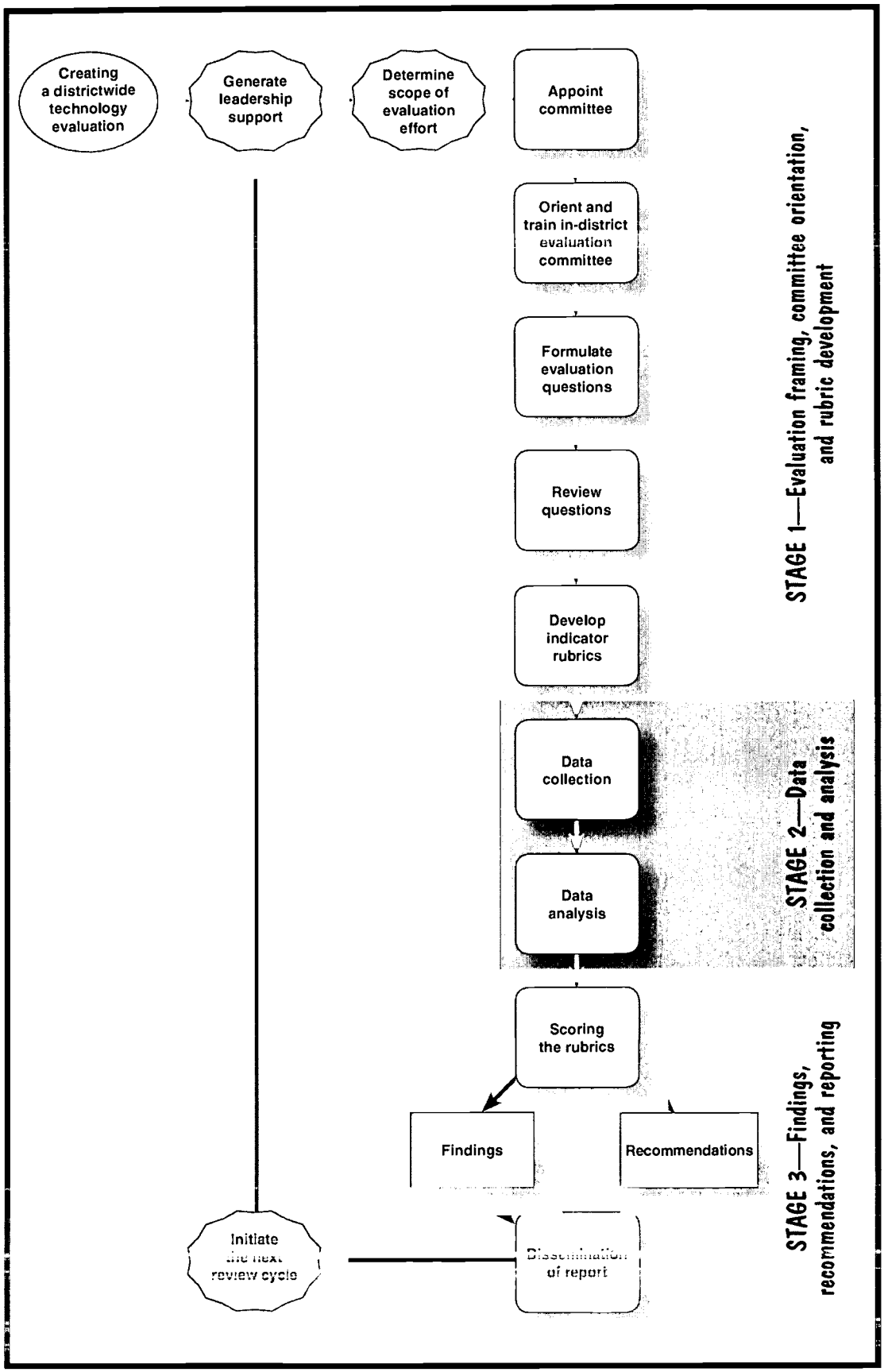

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only observe teachers and students using technology but also find that we can learn much about how technology is being used to impact teaching and learning just by observing classroom setups, teaching styles, and student behaviors.

It is important that the data-collection effort not rely on a single data source (e.g., surveys). The district needs to design a data-collection strategy that has the optimum chance of capturing the big picture of the use and impact of technology within the district. This will require the simultaneous use of multiple data-collection strategies.

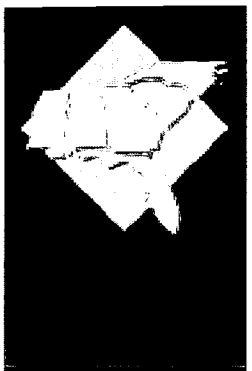
Stage 3—Findings, recommendations, and reporting

Reporting is important to a formative evaluation in that it establishes a common base for reflection. An evaluation that is not shared with the community it evaluates never results in reflection. Reflection is necessary for positive and informed change. The first step in reporting is to take the data gathered in the previous stage to score the district's performance against its own rubrics. These scores—along with a detailed explanation of how scores were given—form the basis of the report. In addition, reports typically contain detailed findings and recommendations. The recommendations relate to how the district can adapt or change current practices to achieve higher levels of performance in succeeding years. The recommendations are always based on a research-intensive knowledge of best practices as related to teaching, learning, and technology. Recommendations are relative to findings. In other words, recommendations are in sync with a district's desired outcomes as documented in its indicator rubrics.

In most cases, evaluation projects end with a formal presentation to the district committee and other audiences as identified by the overseeing administrator. The districts then distribute the document and begin implementation. This is the point at which the next review cycle begins.

These steps for evaluating a technology plan are appropriate for most schools and districts. As the chart indicates, this is a cyclic process for continuous improvement and for greater impact on students and the educational program. ◆

Thinking Beyond Surveys



by Anna Li, Ph.D., SEIR◆TEC Evaluator

For several reasons, surveys are the most commonly used tool for evaluating technology programs. First, they can measure a variety of elements of the program and participant characteristics, such as the number of computers in a school, teachers' and students' attitudes, opinions, behaviors, and other descriptive information. Another positive feature of surveys is that, compared with other evaluation methods, they are relatively inexpensive and can be quickly administered to a large number of people. A third aspect is that survey findings usually lend themselves to quantitative analyses, and the results can be expressed in easily understood percentages and means, which in turn can be presented in easily understood charts or graphs.

However, since the primary way to collect information through surveys is to ask people written questions, the evaluator has no control over misunderstanding and misinterpretation of the questions, missing data, or inaccurate responses. If the entire technology-program evaluation design depends on surveys or self-reporting data, the findings could be biased or not reflect a complete picture of a technology program's quality and effectiveness. Therefore, it is important to think beyond surveys and to

TABLE 1: DATA-COLLECTION METHODS

Data-collection methods	Advantages	Disadvantages
Questionnaires (self-administered)	Good for finding answers to short, simple questions; relatively inexpensive; can reach a large population in a short time.	Low response rate; no control over misunderstanding or misinterpretation of the questions, missing data, or inaccurate responses; not suited for people who have difficulty reading and writing; not appropriate for complex or exploratory issues.
Interviews	Yield rich data, details, and new insights; interviewers can explain questions that the interviewee does not understand; interviewers can probe for explanations and details.	Can be expensive and time consuming; limited sample size; may present logistics problems (time, location, privacy, access, safety); need well-trained interviewer; can be difficult or time consuming to analyze qualitative data.
Focus groups	Useful for gathering ideas, different viewpoints, new insights from a group of people at the same time; facilitator can probe for more explanations or details; responses from one person provide stimulus for other people.	Some individuals may dominate the discussions while others may not like to speak in a group setting; hard to coordinate multiple schedules; takes longer to have questions answered.
Tests	Provide "hard data" that are easily accepted; relatively easy to administer.	Difficult to find appropriate instruments for treatment population; developing and validating new tests may be expensive and time consuming; tests can be biased and unfair.
Observations	Best for obtaining data about behaviors of individuals or groups; low burden for people providing data.	Time consuming; some items are not observable; participant behavior may be affected by presence of observer; needs well-trained observer.
Archival documents (student records, school plans, past program evaluations, etc.)	Low burden for people providing information; relatively inexpensive.	May be incomplete or require additional information; may need special permission to use.
Artifacts or products	Good evidence of impact; low burden for people providing data; relatively inexpensive.	May be incomplete or require additional interpretation.

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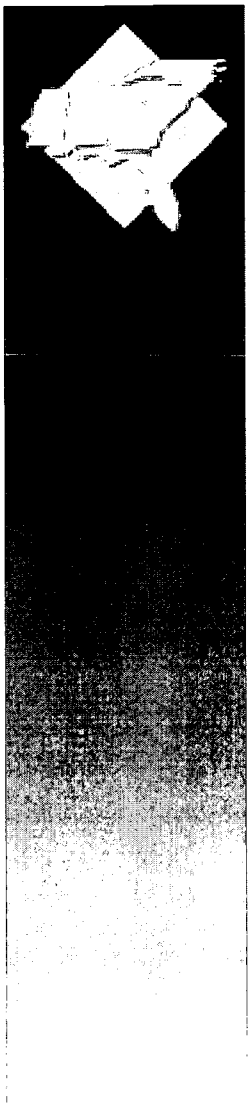

look at other evaluation designs and data-collection techniques. There are seven commonly used data-collection methods in educational technology program evaluation. Table 1 (previous page) summarizes the methods and describes their advantages and disadvantages.

Depending on the needs of the programs, a sound evaluation design incorporates three or more of the above methods. Which methods to use should be determined by the evaluation questions, and complex questions often call for multiple sub-questions, each of which would have an appropriate data-collection method. For example, a frequently asked question of technology programs is: "How are teachers and students actually using technology?" This is a complex question that might be divided into several sub-questions about the extent, nature, and frequency of teacher and student technology use. Table 2 below, which is drawn from the National Science Foundation's *User Friendly Handbook for Project Evaluation* (www.ehr.nsf.gov/RED/EVAL/handbook.htm), shows a simplified version of an evaluation design matrix.

TABLE 2: DESIGN MATRIX

Sub-question	Data-collection approach	Respondents	Schedule
1a. Did teachers use technology in their teaching?	Questionnaires Observations	Teachers Supervisors N/A	Pre/post project Twice per semester
1b. Did students use technology to learn science, math, or other subject areas?	Questionnaires Interviews Observations	Students Teachers	Pre/post project Twice per semester
1c. How often did teachers use technology?	Questionnaires	Teachers Students Supervisors	Pre/post project

The National Science Foundation handbook (p.19) suggests you pose the following questions when you want to determine the most appropriate approaches to data collection:

1. Do you want to explore the experiences of a small number of participants in-depth (case studies) or get general experience for a larger population (survey)?
2. If you select a survey approach, do you want to survey all the participants, or can you select a sample?
3. Do you want to evaluate what happens to project participants or to compare the experiences of participants with those of the non-participants (quasi-experimental design)?

How these questions are answered will affect the design of the evaluation as well as the conclusions that can be drawn. ◆

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Resources for Evaluation: An Annotated Bibliography

by Dan Shoemaker, Senior Educational Technology Specialist, SEIR◆TEC, and Jennifer Burke, Media Specialist, Centennial Place Elementary School, Atlanta

As educators seek research to guide the development of their evaluation plans or tools to use in evaluating their technology initiatives, they often turn to the Internet. Conducting an Internet search can result in an overwhelming list of possible sources of information. Weeding out the useful from the barely applicable is a true headache-producing task.

SEIR◆TEC staff have tackled the task for you. In the charts below, you will find an annotated bibliography of research studies and reports focused on the evaluation of technology programs. Among the items listed, you should find several that will be just what you are looking for to use in your technology initiative evaluation plan.

Books

1. Aspen Education Development Group. (2001). *Administrator's guide to technology: Planning, funding & implementation.* Frederick, MD: Aspen Publishers.

   This document provides guidelines related to instructional technology and planning for administrators. Topics covered include developing a technology plan, facility assessment, e-rate planning, formation of a technology committee, budget planning, and hardware/software replacement plan and costs. Chapter 7 covers assessment and accountability, including evaluating a technology program, technology assessment surveys, and technology standards for continuous student assessment. Appendices include a glossary and a list of resources for acceptable-use policies, assessment and accountability, assistive technology, website accessibility, curriculum integration, distance education, funding, hardware suppliers, international collaboration on the Web, legal issues, professional development, school website design, technology planning and implementation, telementoring, virtual schools, and Web safety.

2. Fink, A., & Kosecoff, J. (1998). *How to conduct surveys* (2nd *ed.*). Thousand Oaks, CA: Sage Publications.

   Popular for helping readers organize a rigorous survey and evaluate the credibility of other surveys by giving them practical, step-by-step advice, the second edition also covers computer-assisted and interactive surveys and how they contrast with telephone and face-to-face surveys.

3. Hedrick, T. E., Bickman, L. R., & Rog, D. J. (1993). *Applied research design: A practical guide.* Thousand Oaks, CA: Sage Publications.

   Aimed at helping researchers and students make the transition from the classroom and the laboratory to the "real" world, the authors reveal pitfalls to avoid and strategies to undertake in order to overcome obstacles in the design and planning of applied research. The book focuses on refining research questions when actual events force deviations from the original analysis.

4. Maruyama, G., & Deno, S. (1992). *Research in educational settings.* Thousand Oaks, CA: Sage Publications.

This book focuses on the following issues: access and credibility in the school; traditional issues in designing research; questions that emerge as the design is imposed on the school culture and setting, particularly in regard to school staff and student assessment; the length of interventions and whether or not to schedule follow-up studies; and how to interpret and communicate findings to schools and policymakers.

5. Quiñones. S.. & Kirshstein, R. (1998). *An educator's guide to evaluating the use of technology in schools and classrooms.* Washington, DC: United States Department of Education. www.ed.gov/pubs/EdTechGuide.

This guide was developed for the U.S. Department of Education by the American Institutes for Research in conjunction with its formative evaluation of the Technology Literacy Challenge Fund. The guide represents a joint effort among the Office of Educational Research and Improvement, the Office of Educational Technology, and the Office of Elementary and Secondary Education. The guide should be viewed as a tool for individuals who have little or no formal training in research or evaluation. This publication is available online in PDF format.

6. Stevens, F., Lawrenz, F., & Sharp, L. *User friendly handbook for project evaluation: Science, mathematics, engineering and technology education.* Retrieved August 15, 2002, from www.ehr.nsf.gov/RED/EVAL/handbook/handbook.htm.

This handbook was developed to provide Principal Investigators and Project Evaluators working with the National Science Foundation's Directorate for Education and Human Resource Development with a basic understanding of selected approaches to evaluation. It is aimed at people who need to learn more about what evaluation can do and how to do an evaluation rather than those who already have a solid base of experience in the field. This publication is available online in PDF format.

Journal articles

1. Moreland, J., & Jones, A. (2000). Emerging assessment practices in an emergent curriculum: Implications for technology. *International Journal of Technology and Design Education, 10*(3), 283–305. www.techednz.org.nz/n_research.shtml.

Reports on detailed case studies into emerging assessment practices in technology in two New Zealand primary schools. Topics include classroom assessment, formative and summative assessment, teacher knowledge, subculture influences when implementing technological activities, knowledge about technology, knowledge in technology, student self-assessment, and expectations of transfer.

2. Sanders, M. (2000). Web-based portfolios for technology education: A personal case study. *Journal of Technology Studies, 26*(1), 11–18. http://scholar.lib.vt.edu/ejournals/JTS/Winter-Spring-2000/pdf/sanders.pdf.

Students can use Web-based portfolios in technology classes to display class and project work. Developing effective websites gives them an understanding of a range of information-age tools, motivates them to do high-quality work, requires self-assessment and reflection, and teaches design skills

3. Wenglinsky, H. (1998). *Does it compute? The relationship between educational technology and student achievement in mathematics.* Princeton, NJ: ETS. www.icoe.k12.ca.us/pdf/technolog.pdf.

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This report presents findings from a national study of the relationship between different uses of educational technology and various educational outcomes. It uses the 1996 National Assessment of Educational Progress (NAEP) in mathematics.

4. Woodrow, J. E., Mayer-Smith, J., Jolie, A., & Pedretti, E. G. (2000). Assessing technology-enhanced instruction: A case study in secondary science. *Journal of Educational Computing Research, 23*(1), 15–39.

   Describes an evaluation program designed to assess the effectiveness of technology-enhanced instruction within the context of the Technology Enhanced Secondary Science Instruction (TESSI) project, a field-based research program of technology integration into secondary science. It includes analyses of student enrollment and achievement, ethnographic assessment, scalability, and interviews with graduates.

Papers presented at conferences and meetings

1. 2000 Conference on Educational Technology, Measuring the Impacts and Shaping the Future.

   The conference focused on the effective use of technology in schools. The site (**www.ed.gov/Technology/evaluation.html**) includes papers and presentations from the Education Secretary's Conference on Educational Technology as well as evaluation tools. Site is updated to 2002.

2. Heinecke, Blasi, Milman, & Washington. (1999). *New directions in the evaluation of the effectiveness of educational technology.* Paper presented at the 1999 Education Secretary's Conference on Educational Technology. **www.ed.gov/Technology/TechConf/1999/whitepapers/paper8.html**.

   The paper addresses the importance of looking at new ways to evaluate the effectiveness of educational technology that incorporate a variety of ways to assess programs.

3. Mize, C. D., & Gibbons, A. (2000). More than inventory: Effective integration of instructional technology to support student learning in K–12 schools. *Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000*, San Diego, California, February 8–12, 2000.

   This paper is a report of three case studies considering the instructional uses of technology in public school classrooms. A level of technological proficiency was determined for each school that participated in the research through the use of a series of surveys, teacher interviews, and observations.

4. Peterson, L. (1999, April). *Transforming the daily life of the classroom: The District Six Laptop Project.* Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Quebec, Canada.

   The paper discusses The Community School District Six Laptop Project (New York, NY) that was created in order to increase access to technology for families in a low-income area with a large immigrant population. Findings from both groups are discussed in terms of collaboration, the writing process, research skills and critical evaluation of information, and presentations. Results of the study suggest that laptops enable change in the management of the classroom and in the design of instructional activities and assignments. **http://metisassoc.com/Publications/aera.htm.** ◆

Tools for Evaluating Technology Projects and Programs

by Dan Shoemaker, Senior Educational Technology Specialist, SEIR◆TEC, and Jennifer Burke, Media Specialist, Centennial Place Elementary School, Atlanta

Finding an evaluation tool that has been tried and tested puts you one step ahead. The resources listed below have been used or developed by SEIR◆TEC or other RTECs and are worth considering when you are searching for a tool to use to evaluate your technology initiative.

1. **CEO Forum STaR Chart** (www.ceoforum.org/starchart.cfm)

   Developed by the CEO Forum on Education & Technology, the STaR Chart identifies and defines four school profiles ranging from the "Early Tech" school with little or no technology to the "Target Tech" school that provides a model for the integration and innovative use of education technology. The STaR Chart is not intended to be a measure of any particular school's technology and readiness, but rather to serve as a benchmark against which every school can assess and track its own progress.

2. **enGauge** (www.ncrel.org/engauge)

   Developed by NCREL with the Metiri Group, enGauge provides a comprehensive view of critical factors in an educational system that strongly influence the effectiveness of educational technology. It is a Web-based framework and tool set designed to help districts use technology effectively for learning, teaching, and managing. The enGauge framework identifies Six Essential Conditions, which are system-wide factors critical to effective uses of technology for student learning.

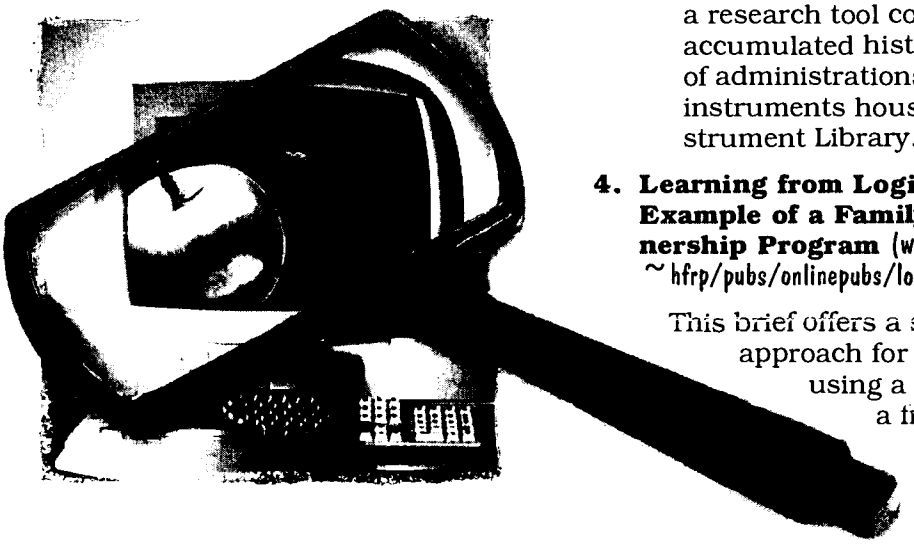
3. **INSIGHT, South Central RTEC Instrument Library and Data Recovery** (http://insight.southcentralrtec.org/welcome.html)

   INSIGHT, the South Central RTEC Instrument Library and Data Repository, is an evaluation resource that serves a broad range of educational constituents. It consists of two distinct but interrelated components:

   - The INSIGHT Instrument Library provides a centralized library of Web-enabled educational evaluation surveys and instruments and is available for program and project evaluators in K–16 education.
   - The INSIGHT Data Repository is a research tool containing the accumulated historical record of administrations of evaluation instruments housed in the Instrument Library.

4. **Learning from Logic Models: An Example of a Family/School Partnership Program** (www.gse.harvard.edu/~hfrp/pubs/onlinepubs/logic.pdf)

   This brief offers a step-by-step approach for developing and using a logic model as a framework for a program's or organization's



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evaluation. Its purpose is to provide a tool to guide evaluation processes and to facilitate practitioner and evaluator partnerships.

5. **North Central Regional Technology in Education Consortium (NCRTEC)** (www.ncrtec.org/capacity/profile/profwww.htm)

   Developed by the NCRTEC, the Learning with Technology Profile Tool will allow comparison of current instructional practices with a set of indicators for engaged learning and high-performance technology. For each category, there is a description of the indicators and examples that fall along a continuum.

6. **Planning into Practice** (www.seirtec.org/plan/Ch%207.pdf)

   As a result of SEIR◆TEC's work in various schools, several valuable tools have been identified that are particularly useful in helping districts and schools create strategic educational technology plans. Chapter 7 of this publication addresses evaluation and provides several tools that may be useful for program evaluation. This publication is available online in PDF format.

7. **Profiler** (http://profiler.hprtec.org)

   Developed by the High Plains Regional Technology in Education Consortium (HPR✶TEC), the Profiler tool and ready-to-use surveys offer a means to improve people's skills around a general topic, strengthen their understanding of a topic, or increase their ability to share expertise. Surveys can be customized for a group and stored on and accessed from the HPR✶TEC server.

8. **SEIR◆TEC Progress Gauge** (www.seirtec.org/eval/gauge.doc)

   Developed by SEIR◆TEC, the Progress Gauge is used to help school leaders reflect on activities to date in technology integration, think about what needs to be done in order to impact teaching and learning through the use of technology resources, and consider strategies for maximizing the impact of technology. The SEIR◆TEC Progress Gauge is also available in an online format in conjunction with HPR✶TEC using the Profiler tool.

9. **TAGLIT** (www.taglit.org/taglit/login.asp)

   Taking A Good Look at Instructional Technology (TAGLIT) is a suite of assessment tools designed to help principals and other school leaders gather, analyze, and report information about how technology is used for teaching and learning in their schools. ◆

This newsletter was developed by the SouthEast Initiatives Regional Technology in Education Consortium (SEIR◆TEC) and is based on work sponsored wholly or in part by the Office of Educational Research and Improvement (OERI), under grant number R302A980001, CFDA 84.302A. Its contents do not necessarily reflect the views and policies of OERI, the U.S. Department of Education, or any other agency of the United States Government.

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SEIR◆TEC Welcomes Kevin Oliver

Kevin Oliver is the new Project Director for SEIR◆TEC as of October 1st. He comes to Durham from Virginia Tech where he worked as an Instructional Design and Evaluation Specialist since 1999. Kevin also formerly worked as an Instructor for the Department of Curriculum and Instruction at Southern Illinois University, teaching graduate-level instructional technology courses to pre-service and in-service teachers, and as an Educational Media Specialist for the UNC-Chapel Hill School of Nursing.

Kevin received his Ph.D. in Instructional Technology from the University of Georgia where he participated in teacher training and the integration of science Web tools in a rural school system. He also holds a M.Ed. in Educational Media and Instructional Design from UNC-Chapel Hill and a B.S. in Communications from the University of Tennessee. Kevin has consulted with computer software companies in North Carolina and Georgia, and he interned with educational media agencies at the U.S. Air Force Academy and Xerox. Since 1992, he has given more than 30 presentations at regional, national, and international conferences; authored or co-authored 13 technology-related publications in journals; and authored or co-authored funded educational technology grants from the Mellon Foundation, Apple Computer, the U.S. Department of Education (Challenge Funds), FIPSE, and the National Science Foundation.

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