THE NATIONAL SCIENCE DIGITAL LIBRARY MAGAZINE/ VOLUME 1, NUMBER 1 / NOVEMBER 2004

Learn NSDL

NSDL would like to thank the National Science Foundation for its generous support and advocacy of NSDL as the NSF digital library of science education.

What's Going On Here?

By NSDL Director Kaye Howe

Our vision is for *Learn NSDL* to be a living science magazine for educators with dynamic links to library resources

Welcome to the prototype of a new publication, *Learn NSDL*. We produced it to find out whether the NSDL community has reached the moment when its energies, activities, and ideas demand a voice. We have gone, as Len Simutis said so well in a recent presentation, from being projects to becoming an institution. The institution we create will have significant responsibility for the welfare and support of teaching and learning, and for how people all over the world accomplish the mysterious goal of knowing things.

Several months ago, Carol Minton Morris, Elly Cramer, and Bill Arms drafted a proposal called "The Magazine Metaphor Expanded: A Community-Based Online NSDL Exhibits Magazine System and Editorial Process for Development, Aggregation, Evaluation, Syndication, and Distribution of NSDL News, Information, and Resources." Despite its elephantine title, that draft contained several good recommendations, and *Learn NSDL* is one of them.

We sought out Brad Edmondson, ex-Editor In Chief of A*merican Demographics* magazine and co-founder of ePodunk.com, as a prospective editor. Brad, Carol and I met in Washington in June. Brad proposed a quarterly format and some ideas for both individual stories and continuing departments. As a result of that meeting, I asked Brad to take on this project for us and create a prototype, to see what all of you think.

Learn NSDL is coming out just before our Annual Meeting so Brad, Carol and I can gather responses and suggestions from the community. Our vision is for *Learn NSDL* to be a living science magazine for educators with dynamic links to library resources. We think this will be a good way to reach the larger communities of science, technology, engineering, and math

education. What do you think? Marty Blume, editor-in-chief of the American Physical Society, has written that electronic publishing is, “an experimental art.” Let us know how this particular experiment is doing.

THE NATIONAL SCIENCE DIGITAL LIBRARY MAGAZINE/ VOLUME 1, NUMBER 1 / NOVEMBER 2004

Learn NSDL

Table of Contents

PUBLISHER
Kaye Howe,
NSDL Director

EDITOR
Brad Edmondson

ART DIRECTOR / PRODUCTION
Carol Minton Morris,
NSDL Communications Director

Please contact Kaye Howe, Brad Edmondson, or Carol Minton Morris with comments and suggestions for future issues of *Learn NSDL*.

Learn NSDL

Contributors to the November 2004 Issue

Brad Edmondson (Editor, cover story, news section, eSkeletons) is Vice President of ePodunk.com and former Editor-In-Chief of American Demographics magazine.

Bob Stein (Books Unbound) is the Director of The Institute For The Future of The Book and was a founder of The Voyager Company.

Wes Shumar (Culture and Communication) is Assistant Professor in the Department of Culture and Communication at Drexel University in Philadelphia, PA.

Jon Crispin (photographs, cover story) lives in Amherst, Massachusetts.

Meredith Small (In Search of N'Ess Dee Ells) is a writer and Professor of Anthropology at Cornell University.

Robert Hole, Jr. (Ask-NSDL: Dinosaurs) is an exhibit supervisor and teacher at the Lindsay Wildlife Museum in Walnut Creek, California.

Michael Weissmann (Ask-NSDL: Scorpions) is an entomologist affiliated with Colorado State University and consultant for insect zoos and butterfly houses with Kallima Consultants Inc.

Sten Odenwald (Ask-NSDL: Dark Matter) is a researcher at NASA's Goddard Space Flight Center and host of the website Astronomy Café.

Cover Story photographs: cover (l-r) Joshua Lerner, Banjamin Maher, and David Mingace, students at Plymouth South Middle School (PSMS) in Plymouth, MA. Page one: Nick Micozzi at PSMS. Page two: Warren Phillips with two students at the computer lab in Plymouth Community Intermediate School (PCIS). Page three: (l-r) Joshua Lerner, Banjamin Maher, David Mingace. Page four: (l-r) Chelsea Wade and Brittany Tringale; (l-r) Nick Micozzi, John Walsh, Brandyn Hawkins, unknown, unknown; (end page) Brittany Bearse.

Learning Better Online: Digital Resources Reconnect Reluctant Learners

By Brad Edmondson

Some educators are saying that digital resources have become strong enough to create another quantum leap in education.

Above: Nick Micozzi in Middle School, Plymouth, Massachusettes.

Jim Fraser used to teach fourth grade at a public school in Harlem. When the 1969 school year began, he noticed that his students had changed. “Everything had speeded up in their heads,” he says. “They suddenly expected lessons to be delivered in 30-second sound bites.” He soon discovered that the whole school was hooked on a new television show called “Sesame Street.” The children looked forward to watching the show because it reflected their own lives in an urban neighborhood, but also because it copied commercials: It was entertaining and bright, with singing puppets and cartoons delivering lessons about letters and numbers and cooperation.

Fraser had a first glimpse of something big. Young children who grow up watching “Sesame Street” are significantly better prepared when they enroll in kindergarten than are children who do not watch it, according to studies conducted over the show’s 35-year run. Moreover, “Sesame Street” appears to be particularly good at preparing children who live in low-income families and other situations that place them at risk of poor performance in school. “The pace of learning got faster,” Fraser says. “The teachers had to adapt to it in ways more radical than we ever imagined.”

Technology delivers a steady stream of small benefits to teachers. But now some educators are saying that digital resources have become strong enough to create another quantum leap in education – a “Sesame Street” moment, if you will. This time, teachers are using new kinds of digital learning to fuel middle and high school students’ interest in science and math. “We’re going to have another paradigm shift in learning,” says Nick Micozzi, K-12 Science Coordinator of the public schools in Plymouth, Massachusetts. “It’s been a long time coming.

Micozzi and others suspect that the new forms of learning have enormous potential for re-engaging students who are reluctant to learn. But reseachers caution that there's a right way and a wrong way to make the change, and some school districts may be wasting large sums on equipment and software that won't deliver on its promises. "There are a lot of traditional teaching practices that don't work, and digital developers can unconsciously transfer those false assumptions into their products," says Katherine Hanson, Director of Education, Employment and Community Progams for the Education Development Center (EDC) in Newton, Massachusetts. "If something doesn't work in face-to-face teaching, there's no reason to assume that it would work in a digital environment." *(continued)*


Cover Story
Learning Better Online
DIGITAL RESOURCES RECONNECT RELUCTANT LEARNERS
By Brad Edmondson
Photographs by Jon Crispin

Learning Better Online (*continued from page 1*)

There are a lot of traditional teaching practices that don't work, and digital developers can unconsciously transfer those false assumptions into their products.

Whether it's done well or done poorly, the shift to online learning is coming to every school. We looked at two districts, one with near-universal home internet access and one where access is much lower, and found several ways in which the new technology improves learning.

IT DOESN'T JUST LIE THERE

James Smith is in the computer lab at Plymouth Community Intermediate School, putting together a web page. He is in the eighth grade, and he has had a computer at home since first grade. "When you have a question with a book, you have to go to the index and flip back and forth to get the answer," he says. "I like the computer better because you can go straight to the help bar." Next to him, Justin Ehnes agrees: "I learn on computers much more than books. The internet is better because you can actually see things moving. It doesn't just lie there."

Warren Phillips moves through the aisles of the lab, looking over students' shoulders. Their web pages are really reports on various animals that live in the bogs around Plymouth and in Louisiana's bayous. The students grab images from a list of web sites Phillips has chosen, including an Ebsco database of journals, Video Discovery, and the National Digital Science Library (NSDL). The students don't stop there, though. Kaitlin Lockett, a seventh grader, is putting together a report on bobcats that includes facts from a trapper's web site. Alex Brown went to Google and got his picture of a red-winged blackbird by doing an advanced search of image files. "I learned how from my sister," he says.

"I've been using the web to teach for about eight years," says Phillips. "There came a point not long ago when it really took off, both in the supply of good material and in students' ability to use it. Now it seems to pick up speed every year. It's like watching the Berlin Wall come down."

Students in the Plymouth district have important advantages. "About 90 percent of our students have internet access from home," says Nick Micozzi. "We are a district with rich and poor families, but we reached the point where almost everyone had a home computer. Those who don't have home access can get online by staying after school."

The high proportion of home access allowed Plymouth's two middle schools to move their science program away from strictly using paper textbooks about five years ago. Now they are using Pearson Prentice Hall's Science Explorer series, which delivers instructional material using both online and hardcover texts. "The administrators love it because the cost savings are phenomenal, and the teachers like it because the material stays fresh," says Micozzi. "A textbook can cost $65 and is obsolete and worn out in a few years. These sites deliver material for about $4 a year per child and are updated regularly."

The change also appears to be raising scores at the bottom of the scale. In the spring 2004 wave of the statewide Massachusetts Comprehensive Assessment System tests, Plymouth Middle School

students were near state averages in the proportion who ranked “advanced” or “sufficient,” but they were twice as likely as the state average to receive a “needs improvement” ranking and half as likely to fall into the lowest “warning” category. “That’s significant because we used to track the state averages closely,” says Micozzi. “We’re now picking more students off the bottom and moving them up.”

One reason online learning re-engages reluctant learners is because it offers immediate gratification, says Micozzi. “Imagine a 13-year-old boy watching television with a remote control. That boy clicks around the channels fast enough to give an adult an epileptic fit, but that is the way he prefers to access information. When we force him to sit still and listen to a lecture, we’re not adapting the instructional environment to changes in their learning styles.”

Another reason is that the Internet gives teachers more ways to connect students with projects they find exciting and meaningful. On an overcast September morning, Plymouth South Middle School science teacher Judy Bradley hands out clipboards and charts and sends her students outside to look at clouds. They stand in the parking lot in groups of three and four, with a storm blowing in low stratus clouds from Cape Cod, squinting at the sky to decide whether the higher haze might be cirrocumulus. Everyone is intent because when they get back to the classroom, their readings will be sent to NASA as “ground truth” observations to be checked against readings being taken by a CERES (Clouds and the Earth's Radiant Energy System) satellite that is passing overhead.

NASA’s Students Cloud Observations On-Line (S’COOL) project involves1,700 teachers in every state of the U.S., along with 64 other countries. Back in the classroom, Bradley shows the site on an LED projector and takes questions from the excited students before they enter their readings and send them off. Bradley has been a science teacher for 27 years and says that the classroom tools she has now are like a new world: “In this school, I pinch myself every morning.” *(contintued)*

Learning Better Online (*continued from page 2*)

We are a district with rich and poor families, but we reached the point where almost everyone had a home computer.

ick Micozzi is particularly interested in applying this kind of teaching to the educational problems of boys. More than two-thirds of secondary school students in special education programs are boys, according to the 1992 report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA), and three-quarters of those diagnosed with learning and emotional disabilities are boys. Several studies have estimated that among children with Attention Deficit/ Hyperactivity Disorder, boys outnumber girls four to one.

“As a rule, girls usually have an advantage in writing and verbal ability,” says Micozzi. “This gives girls a big advantage in classrooms where the teaching happens through speaking and listening in groups. I think we have an opportunity now to serve boys who can’t express themselves as clearly or as quickly as girls can, because we can use new technology to make lessons that are different for each individual. We’ve always known that paying attention to individual differences gives students the best kind of education, but in practice we’ve never been able to do it. Now we can.”

REACHING FURTHER

They’re installing equipment now in classrooms in Glens Falls, New York. Middle school students there will take a Palm Pilot-like device from a basket as they enter a classroom, answer quiz questions on the device, and send the answers to a server with a wireless connection. The server will grade the quizzes and send them back to the students within minutes. The teacher will instantly know which questions were missed most often, so they can spend the rest of the class reviewing that material. And the quiz results could be at the State Capitol by the end of the class, if assessment standards should ever require that.

Glens Falls is a town of about 15,000 people in the foothills of the Adirondack Mountains, about an hour’s drive north of Albany. It is not a wealthy place, with more than 40 percent of the children on free or reduced-price lunch programs in three of the school district’s four buildings. But a few months ago, Glens Falls and three neighboring rural districts got the first installment of a large federal grant connected to the No Child Left Behind law. Now the districts are installing broadband connections with each other, and they’re buying Palm Pilots and laptops. They’re buying videoconferencing equipment so children in rural New York can take virtual field trips to the San Diego Zoo. They also ordered an information system from Scantron, Inc. that will manage the wireless quizzes, data storage, and reporting.

“One of the big ideas in getting this grant was power in numbers,” says Stephen Danna, secondary curriculum director for the district. “Warrensburg is a district with 700 kids. They might not have a calculus teacher, but Glens Falls does. Now our teacher can work with students up there. Another need came when the No Child Left Behind law passed and we suddenly had to do a better job of assessment. But the thing I’m most excited about is what this will do for our teachers.

“We were holding a staff development day on how to use the performance software, and one of my

teachers was complaining about it; she didn't want to give up a day of her time. But she came back energized. She now has a fast way to know exactly where each child in her class stands, so she can create an individual study packet tailored to each child's needs. This used to take so many hours to do that few teachers did it. Now it takes a lot less time."

At another technology training session, Danna showed the NSDL site to high school teachers. A physics teacher typed in "Charles Messier" and immediately got a dozen sources on the 18th century French astronomer. A statistics teacher found several data sets he knew would be of interest to her class. "They were all crowding around and saying, 'wow, this is good,'" Danna says.

"This is how you get to the reluctant learner," he continues. "Kids come in to school saying 'I'm forced to be here, where's my choice, where is the meaning in this class work.' Now my statistics teacher can ask them what they're interested in. One student might want to know about the salaries of baseball players. Another might want to know changes in the price of gasoline. The teacher can go back to NSDL and get data sets she knows will keep the kids interested while she shows them how to build histograms."

Who's Reluctant?

Reluctant learners tend to have the same characteristics. About one-third of public school students graduate from high school with at least one risk factor associated with poor academic performance, according to an analysis of the National Education Longitudinal Study. Specifically, 27 percent of graduates had changed schools two or more times between first and eighth grade; 17 percent had a "C"average or lower from 6th through 8th grade; 15 percent lived in a single-parent household in eighth grade; 11 percent had at least one older sibling who had dropped out of high school; and 11 percent were held back one or more grades between first and eighth grade. In 2000-2001, the proportion of 9th grade students who dropped out before they completed high school ranged from 2 percent in North Dakota to 11 percent in Arizona (http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2004310).

All of these characteristics are related to a lack of cash, and in fact18 percent of at-risk high school graduates lived in households that fell in the lowest income quartile. Such households are the last to sign up for an extra expense like the Internet. About 135.4 million Americans actively use the internet at home, according to a September 2004 estimate by Nielsen//Netratings. This is about half of the U.S. population aged 5 and older, and the rate of growth has been slowing for several years. Children in middle and high schools are among the nation's most active Internet users: the proportion who are actively online at home rises from 42 percent for those aged 6 to 11 to 63 percent for those aged 12 to 17, says Nielsen. Moreover, the majority of children who are on-line at home have a broadband connection, and the share of online houdeholds with broadband is rising rapidly. But Census data show that the lower a household's income, the less likely a child in that household is to have any on-line access at home.

"When you're growing up in an enriched environment, you have a big advantage," says Steve Danna. "If you don't have home Internet access, then the school's access becomes critically important. In our highest-need building, less than 30 percent of students have home access." To bridge that gap, Glens Falls plans to open its school computer lab to the community during certain hours, and it will subsidize access to computers at the city's popular Youth Center. *(continued)*

Learning Better Online (*continued from page 3*)

We've always known that paying attention to individual differences gives students the best kind of education, but in practice we've never been able to do it. Now we can.

In 2001, the No Child Left Behind law created several federal grant programs to give low-income students better access to educational technology. At least $1.5 billion in federal funds was distributed to schools for educational technology in 2002, according to estimates compiled by Baltimore Sun reporter Alec MacGillis. He estimated total public school spending on educational technology from all sources at $2.3 billion. But much of that money isn't being spent wisely, MacGillis concluded in a series of Sun articles called "Poor Schools, Rich Targets" that was published on September 19-25. (http://www.baltimoresun.com) Struggling schools are spending heavily on software designed to raise test scores, but much of this software is electronic versions of rote drills that help children memorize test answers. Teaching to the test, the bane of motivated teachers everywhere, has simply gone electronic.

"If you come from a computer science background, you're not likely to understand that children are diverse and have diverse styles of thinking," says Katherine Hanson of EDC. "Some software designers have become very reflective and have designed wonderful materials, but others just don't think about it.

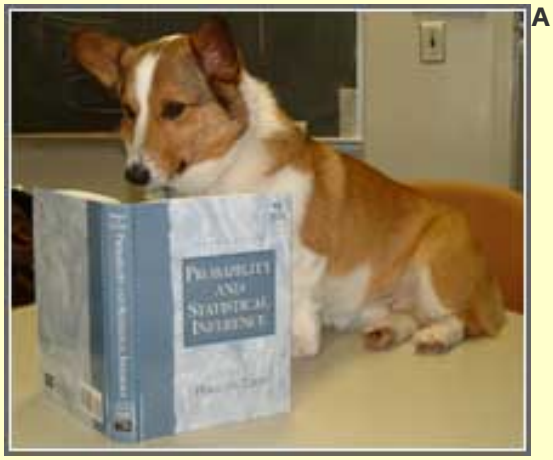
"The challenge is to integrate different cultural perspectives and values into the learning environment. And I don't care whether it's a classroom or a website, we just haven't spent a lot of time thinking about this yet. If you have a white mainstream middle-class perspective, you're the person in power – and unless you're educated about the differences, you simply don't see them."

Nick Micozzi is pursuing a goal of science and math education with something for everyone. It is an environment that switches from lectures to computer screens and back again, and where a lab is as likely to take place on a web site as it is on a classroom table (link: "Virtual Labs work just as well" in News section). "The NSDL is really the third part of a triumvirate," he says. "The first part is traditional textbooks. The second part is searchable periodical literature. The third part is web links for real time data."

"E-learning in all its forms is really on the ascendancy right now," says Tim Magner, deputy director of the Office of Educational Technology at the US Department of Education. "But what I hope stays the same is the emphasis on the individual and the delight in learning. We need to use technology in appropriate ways to foster that. What we're wrestling with right now is what we need to put in place so that personalization can happen." Talk to the teachers who get it, and they'll tell you that the prize is worth the struggle. "I'm delighted that there's all this upheaval and pondering," says Jim Fraser, who went on from the Harlem public school to become Dean of the School of Education at Northeastern University and is now a visiting professor at New York University. "The worst thing we can do is pretend it's not happening."

Elvis, The Dog Who Knows Calculus and Other Amazing Stories

MAA Focus: A Dog With A Degree, Nerd Movie Critics, Internet Scout Focus: Rock-Climbing Robots, ENC Focus: Flu Pandemics, Wireless Classrooms, Huge Fedoras, Web Tips for Middle Schoolers, and More



Above: Elvis brushing up on basic concepts.

"Things keep happening," says Tim Pennings, associate professor of mathematics at Hope College in Holland, Michigan. "Prentice-Hall is reprinting an article about Elvis in a seventh-grade textbook. A writer from Switzerland wants to include him in a book called *The 100 Most Surprising Science Experiments of the Last 700 Years*. And there's his honorary degree, of course."

Pennings is talking about his dog, a Welsh Corgi named Elvis, who received an Honorary Doctorate in Canine Letters from Hope College earlier this year. The dog's big break came 18 months ago, when Pennings wrote an article for a journal published by the The Mathematical Association of America with the provocative title, "Do Dogs Know Calculus?"

"I live nine miles from Lake Michigan, and Elvis' greatest joy is to retrieve tennis balls," says Pennings. "I noticed that when I threw a ball into the water for him, he followed pretty much the same path every time." By choosing the point at which he entered the lake, Elvis was solving a classic calculus problem: namely, finding the route from A to B that takes the least amount of time if you must travel at two rates of speed.

"Suppose that r is Elvis' running speed and s is his swimming speed," wrote columnist Ivars Peterson on the site MAA Online shortly after Pennings's article was published. "If x is the perpendicular distance from the shore to the target, y is the distance from the point on the shore opposite the target to the point at which the dog plunges into the water, and z is the total distance along the shore from the point at which the ball is tossed to the point opposite the target, the following equation gives the value of y that minimizes the retrieval time:

$$y = \frac{x}{\sqrt{r/s+1}\,\sqrt{r/s-1}}$$

Pennings took a tape measure, a screwdriver, Elvis, and a friend to the beach one summer day. With the friend, he clocked the dog's average running and swimming times. Then he extended the tape measure 15 meters on the beach, threw the ball in the water, ran after the dog, plunged the screwdriver into the sand at the point where Elvis entered the water, grabbed the free end of the measuring tape, and raced the dog to the ball. After three hours, he had 35 measurements. dog's entry points to the optimal value. The dog nailed it almost every time.

Although the math professor clearly loves his dog, he has no illusions. "Elvis does not know calculus," he wrote. "In fact, he

He might get more dog biscuits than he used to.

has trouble differentiating even simple polynomials. More seriously, although he does not do the calculations, Elvis's behavior is an example of the uncanny way in which nature often finds optimal solutions."

Elvis was all the talk at a MAA meeting in 2003, and the Association has since used his image on two of its membership letters. In addition to Peterson's column, Elvis has been featured in several major publications and on ABC News. "It hasn't affected him much," says Pennings. "He gets out a bit more because I take him along when I visit high school classes. People stop me to have their picture taken with him. He might get more dog biscuits than he used to.

Pennings plugged Elvis' running and swimming times into the equation above yielded the predicted optimal value of y as 0.144x. Finally, he plotted the 35 ball-fetching measurements on a scatter chart and compared the

"It's funny," he says. "I've been doing research for years, and the thing that gets me attention is my dog. But I'm not complaining. I'm single, and he is the best way to meet girls I've ever found."

Above: Pennings and Elvis.

(News continued)

Above: How come the surf's not up?

NERDS BLAST HOLLYWOOD PHYSICS

The 1996 film "Independence Day" may be good entertainment, but its treatment of the laws of physics is insultingly stupid. As the film begins, an alien spaceship one-quarter the size of Earth's moon shows up in our atmosphere with no ill effects (until it attacks). But if an object with that much mass ever parked itself so close to Earth's surface, the result would be huge tidal surges. Also, the ship's braking thrusters would probably make fry bread of our landscape even before it launched its first destructo-ray. Later in the movie, the hero plugs his Apple

The ship's braking thrusters would probably make fry bread of our landscape even before it launched its first destructo-ray

laptop into the aliens' computer network. It works right away! And the movie's climax shows earthlings cheering as the defeated spaceship falls out of the sky. In reality, they would be witnessing the end of civilization. "The airflow velocity of a disk that large would be supersonic," says Tom Rogers. "It would hit like several thousand nuclear bombs. If the fuel exploded, it would be even worse." portrayal of the sinking was awesome," they said of the movie "Titanic" (1997). "It had it all: linear and rotational velocity, acceleration, and inertia with torque, forces, Archimedes principle, and fluid dynamics."

More often, they are critical. "It started when I saw the first Indiana Jones movie and noticed that every bullet that hit anything made a great big flash," says Rogers. This is highly unlikely, he explains, because most bullets are made from lead or copper, which don't spark when they hit things. The review was a hit, and now Intuitor gets over a million unique visitors a year.

"I'm always trying to find ways to get people to think about physics outside of the classroom, and this seemed like a good way to do it," he says. But there's a lot more to the site than movie reviews. It is also a center for devotees of a game Rogers invented called "Forchess" that involves four players moving four chess sets on the same board. It has thoughtful essays with titles such as, "Why Now is The Most Exciting Time in History to Be Alive." It even has a page where you can buy a t-shirt showing the Periodic Table of the Elements.

Maybe it is a good physics lesson to point out that the bombs dropped from airplanes in "Pearl Harbor" aren't accurate because they fall straight down. But isn't it also a bit – well -- nerdy? "Yes," says Rogers, who is a shameless cheerleader for single-minded science and

SCOUT FOCUS: A ROCK-CLIMBING ROBOT

The Internet Scout project is starting its 11th year of finding and presenting Web-based information and software to educators. About 350,000 people a week look at Scout's reports; others use the site's open source software to organize and present their own materials online. In late October, the Scout report for Math, Engineering and Technology had eight recommended sites under the subheading "research." One of the best was the site of Stanford Ph.D candidate Timothy Wolfe Bretl, who is "currently working on the design of motion strategies for autonomous mobile robots." Bretl dreams of robots that can climb cliff faces to rescue hikers or go into collapsed buildings to look for survivors. By designing machines that can find handholds and plan their own ascents, Bretl is advancing research in computer vision, manipulation, and "tactile mechatronics." His site also has cool movies of a planar three-limbed climbing robot slowly shimmying up a wall. See it here Check out all of Scout's current offerings here.

ENC FOCUS: THE BIG FLU

Each week, the Eisenhower National Clearinghouse (ENC) publishes a new issue of *ENC Focus*, an online magazine highlighting selected teaching resources for math and science. One of the issues

Rogers teaches advanced physics, computer science, and statistics at Southside High School in Greenville, South Carolina. He holds a patent and lives in a self-designed passive solar home. But he is best known for a section on his website, Intuitor, that reviews Hollywood movies from a physicist's perspective. Sometimes the reviewers -- Rogers and his two sons -- are enthusiastic. "The big screen

math enthusiasts. Rogers worked for 18 years as a chemical engineer. "I became a high school teacher because I realized there were lots of young nerds growing up who needed to know that being a nerd was not just OK but something wonderful," he wrote in *Newsweek* article titled "Let's Celebrate Nerdiness!" The intense devotion of the nerd to his or her subject is responsible for most of the world's great discoveries, he points out. And they need not be wimps, either. Rogers' eldest son could recite the elements from memory while in middle school; he later hitchhiked through Europe three times. His younger son scored 1600 on the SATs and was an Eagle Scout; he is now serving in Iraq. So smile when you say nerd, partner.

now posted on the site gives teachers a rare opportunity to combine science with history and public health in a way that also informs students about current events. The subject is influenza – specifically, the worldwide pandemic that began in 1918 and killed 20 million people before it ended in 1920. With the flu and a potential pandemic in the news again, the issue is particularly timely. ENC Instructional Resources specialists Faith Anne Myers and Ed Cross have reviewed 21 websites and several ENC sources. The resources range from an interactive model for 6th graders that explains the flu and how it is spread to first-hand (*continued*)

(News continued)

accounts of the devastation the 1918 virus caused in army barracks. Other sources give up-to-date information on the vaccine shortage and its role in the flu season of 2004-05. The report suggests ways for students to weigh in on the debates over whether viruses are alive, or why the curve showing mortality rates by age for the 1918-20 pandemic looks like a "W" instead of a "U". Look for Volume 12, #34 of ENC Focus here.

DREAM OF A WIRELESS CLASSROOM

One teacher would like to make digital voice recordings of lessons that students can put on their Ipods and review on their way to class. Another would issue each 9th grade student a Palm Pilot pre-loaded with school policies and calendars that could be synchronized and updated over the next four years. Teachers and students have exactly the same goal when it comes to using technology in the classroom: no barriers.

Students and teachers both put top priority on having fast, wireless Internet access throughout the school, according to national "Speak Up" surveys taken by the not-for-profit organization NetDay. Speak Up Days for students were held in 2003

Teachers and students have exactly the same goal when it comes to using technology in the classroom: no barriers.

Both teachers and students say that the biggest obstacle to using technology and the Internet at school is "lack of time in the school day." Other reported obstacles are not enough working computers and slow Internet access. Many teachers also reported "filters and firewalls" as an obstacle, which reflects greater sophistication and an understanding that filters block helpful sites along with harmful ones. A teacher in Hamburg, NY wished for "removal of the filter system, or a separate account for teachers allowing us to bypass the filter."

The survey indicates that teachers are eager to use Internet search tools like the National Science Digital Library that can save time by filtering out non-relevant sites. But it also shows that if a filter is too strict or doesn't allow teachers the flexibility to do things their way, they are likely to reject it. See the report here.

THIS FEDORA HOLDS EVERYTHING

What's the biggest difference between the National Digital Science Library (NSDL) and a traditional library? Maybe this: Most of the information in a traditional library is delivered in bound sheets of paper. Information in the NSDL is drawn from many different digital collections, so it is created, packaged, re-packaged, and delivered in hundreds of different ways -- websites, downloads, software, and so on. Books

GOOGLE TIPS FOR TEACHERS

Where do you go on the Internet if you need to find good answers fast and free? David R. Ashdown knows. He is Coordinator for Instructional Technology Integration Programs at Washington-Saratoga-Warren-Hamilton-Essex BOCES, a five-county teacher support center based in Saratoga Springs, New York. Part of his job is giving tips to teachers who want to use the Internet but can't waste time. Here are a few of his suggestions on how to use the mother of all search engines, Google .

1. Once you learn a few searching tips on Google, you can usually find relevant lesson plans and classroom activities quickly. For example, try putting phrases in quotes to get better search results (such as "Fraction Lesson Plan", or "grade 4"). If you don't see what you like on the first page of the search results, don't click through pages and pages of results. Try rephrasing your search to get better results (such as "math lesson" and "fractions grade 4"). It may take a few different searches to find exactly what you want.

and 2004. The first Speak Up Day for Teachers, held in April and May 2004, collected online surveys from a nonrandom sample of more than 11,000 teachers from kindergarten to grade 12.

Speak Up teachers reported that the Internet is a mainstream teaching tool. One-fifth of them (22 percent) always include it in the resources they give to students, and more than one-half (53 percent) sometimes include Internet sites. The use of Internet sites is similar for male and female teachers, and it is also evenly distributed among teachers of different ages and races. When asked how they learn about new technology and Internet sites, 25 percent of teachers say they simply explore on their own, 22 percent rely on the expertise of their peers, and 22 percent ask technology staff or librarians. Relatively few teachers said they find out about new resources from advertising or their students.

haven't changed much lately, but information technology is changing rapidly as programmers update their delivery systems and add new ones. How do you make it possible to store, find, and deliver a huge amount of material in diverse formats that are rapidly changing? The NSDL's answer is Fedora, which stands for Flexible and Extensible Digital Object and Repository Architecture.

Work on Fedora began in 1997 with funds from the National Science Foundation and the Defense Advanced Research Projects Agency (DARPA). The original developers at Cornell University joined with the University of Virginia in 1999, and with funding from the Andrew W. Mellon Foundation, moved Fedora from a research project to open-source software for building digital libraries. Since then (*continued*)

2. Another tip is to use the word "interactive" in front of your search (such as "interactive decimal activity"). This will help you to find the kind of resources that will keep your students interested. One great example of an interactive math site is A Maths Dictionary For Kids. It is an online dictionary of math words for elementary students. Each word comes with an interactive activity that illustrates its function.

3. Google's image search is a great teaching tool. Before using this one with students, make sure you activate "Strict Filtering" in the site's "Preferences" section. Try running an image search for "George Washington." You'll be amazed at the variety of visual resources the site generates for use in student reports and presentations. Remember to have students keep track of their sources.

(News continued)

several other institutions have used Fedora to build digital libraries, including Northwestern University, Tufts University, the National Library of Denmark, and the Arrow project in Australia. Fedora can be freely downloaded here.

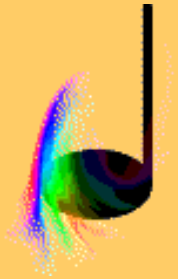
Up to now, the NSDL has mostly been built using "metadata."which is information

Fedora makes it possible to create "digital objects", which are like containers consisting of metadata, local content, and links to content located anywhere on the web.

similar to that found in a standard library catalog – for example, the title, author, and description of an NSDL resource. The form of metadata used in the NSDL is known as Dublin Core, which has been widely adopted by digital libraries. Metadata is accessed from NSDL collection providers via the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Metadata and these two technologies have allowed NSDL to build a first version of the library, but the breadth of the materials relevant to the NSDL and the variety of the target audience call for more powerful technologies.

Fedora makes it possible to create "digital objects", which are like containers consisting of metadata, local content, and links to content located anywhere on the web. Then "behaviors" can be associated with these digital object containers. The behaviors are programs that can transform the content and "disseminate" it into other formats or translations. For example, a digital object containing a high-resolution image could disseminate that image in multiple forms, including a thumbnail for identification or a low-resolution image suitable for viewing in a web browser. A digital object that links to a set of web-based images and a lesson transcript could disseminate an interactive slide show built from those

WHAT MAKES A WEB SITE ROCK?



"Some things are universally annoying," says Joanne Silverstein. What she means is that when you're designing a computer interface, some rules apply to all users. According to her

research, adults and middle-school students both report that they dislike websites with irrelevant images, too much text, pop-up windows they didn't ask for, and slow loading times. But Silverstein's research also indicates that some design elements have a strong and specific appeal to middle-school students. Her team is using these elements to create interactive activities that will bring more middle-schoolers to the National Science Digital Library (NSDL) and will allow them to have fun using its collections.

Silverstein is a Professor at Syracuse University and Principal Investigator for Students Using NSDL , a two-year grant that will be tested this spring. During the research phase of the grant, the SUN team interviewed ten sixth, seventh, and eighth graders in their schools. Members of the research team asked the children to share their favorite web sites and talk about why the sites are their favorites. "Children at this age want to be treated as adults, but they're still kids," she says. "The ones we talked to wanted explanatory text, sidebars, and multiple points of access, just as adults do. On the other hand, their favorite sites were in bright colors with lots of graphics and music. I think we saw that we should have those youthful elements, but if we don't also have good content, they'll leave."

A good example of how to walk the line successfully is the British Museum's website for students on ancient Egypt . This site isn't childish, but it is easy to understand. The graphics are colorful but historically accurate. Click on a highlighted word in the text, and up comes the word's definition in a pop-up window. Click on a picture of the goddess Isis and up comes her biography. Play a game that takes your hero on a journey through the underworld, and you learn about Egyptian mythology. When you win the game, you get a look at the ancient Egyptian version of heaven.

"Children like to see an immediate reflection of their presence on the site," says Silverstein. In other words, children who grew up playing video games prefer educational games that allow them to see their score and advance to higher levels. Children who grew up with Instant Messenger like to have conversations with others while they're playing games and looking at things online.

"Anything that facilitates comunication, either between children or with instructors, they will get immediately and use

sources. Fedora will also allow the NSDL to store richer metadata than it does now, which will improve the types of searches that users can perform. Finally, Fedora makes it possible to define relationships between resources and people in multiple ways. This will make it possible to link educational resources to state standards.

NSDL will begin using Fedora to manage its collections early in 2005. At first, the results will not be entirely visible to users. But over time, Fedora combined with other technologies will make it possible for the NSDL to become more than just a place that offers access to resources. NSDL will become an environment that is contributory and customizable, with linkages between resources and the people, organizations, standards, and curriculum to which they relate. A more detailed account of FEDORA is available here.

heavily," she says. "We see this in 'ask-a' services such as Ask-NSDL. Middle schoolers become much more motivated and excited when they can ask an expert themselves and get a personalized answer."

The SUN team, which includes researchers, engineers, and school teachers, is developing three interactive activities for middle schoolers that will give them engaging ways to start using NSDL resources. "Doctor Darwin's Notebook" is the working title for one of the activities that builds on the eSkeletons website to teach both evolutionary biology and the scientific method. "Our story is that one day, when Charles Darwin was walking through the rain forest, he dropped his notebook," says Silverstein. "Then we show a page from it. It's an evolutionary tree that shows the relationships between different species, but the species are all mixed up. We invite students to go help Dr. Darwin reassemble his notes by suggesting they go to eSkeletons and work with the bone samples to figure out the proper places for each species in the cladogram. Along the way, we show them how they are using the scientific method – creating an hypothesis, collecting data, making a case, and sharing the results. When they're done, they can see the results and see how they did."

SUN's "interactivities" will be served up in two strengths: one for children "who are just wandering around on their own and want to play," says Silverstein, and another for teachers who want to use the actvities in the classroom. The first version has no quizzes and children are encouraged to click on whatever interests them, which Silverstein calls "learning in any direction." The second version includes a lab notebook function so students can record their processes and findings to share with teachers. The research team is currently looking for middle-school classrooms where they can test the interactivities, which should be ready for use in the 2005-06 school year. The research team will also prepare a report on how middle school children can contribute to the web site design process, and on how the three activities affected learning, classroom practice, and traffic on the NSDL site.

(News continued)

SHODOR FOCUS: INTERACTIVATING MATH

Nathan Moss has learned math by watching a teacher talk and draw on a whiteboard, and he has learned math by playing games on the Internet. "I like the games better," says Moss, a third-grader in Knoxville, Tennessee. "They're fun, and you can learn something at the same time."

One of Nathan's favorite computer math games is called "Estimator." It asks him to estimate the number of dots on a screen – there are hundreds – and when you take a wild guess, it offers you a hint by putting a grid over the dots. If you count the dots in one section and multiply that number by the number of sections, you get within a few dots of the answer. The game is part of a series of science and math exercises called "Interactivate." It is available for free on the web site of the Shodor Education Foundation Shodor put the games up 4 years ago, and now they get over a million page views each month.

"I love them," says Meg Moss, who is both Nathan's mom and a teacher education coordinator in the mathematics department of Pellissippi State Technical Community College in Knoxville. "I use them in class, my students use them on their laptops in class, and I give them as homework." Meg's students are undergraduates being trained as elementary school teachers. "There are buttons on top of each activity called what, how, and why," she says. "You click on them and find out how the activity fits into state standards, or get lesson plans for it."

Moss is in the second year of directing a three-year National Science Foundation grant to improve science and math teacher training for elementary schools. "So many elementary school teachers are terrified of science and math," she says. "We're giving them a firm that's how you'll teach it. We're trying to change that. Our model is hands-on. The trainees learn to lead an elemenatary math or science class by manipulating activities instead of just talking and handing out sheets of paper."

"Teachers like Interactivate for two basic reasons," says Robert Panoff, executive director of SHODOR. "First, it's free. Second, we build the activties by asking teachers what they need and then giving it to them." All

It's a question of integrating technology into teaching effectively, instead of just throwing a gadget at a teacher and saying 'use it.'

middle-school students in Maine now have laptops loaded with SHODOR activities, as do middle school students in Boston and Richmond, Virginia. "They make it easier to teach things like spreadsheets," says Bethany Hudnut, Interactivate's direcor. "It's hard to lead a class through ten steps when you're using Excel. With these, you don't have to."

Meg Moss has trained about 400 teachers so far. "It's a question of integrating technology into teaching effectively, instead of just throwing a gadget at a teacher and saying 'use it,'" she says. "If they've never seen it done, how are they going to do it? We're showing them a new way to teach math and science."

TEACHERS' DOMAIN FOCUS: MIXING IT UP

"We used to have a shelf of videos. They were something you used if you had a sore throat or an emergency so you couldn't teach," says Melanie Myers, who has had a fourth-grade class at

Last year, Myers' school district subscribed to Teachers' Domain, an educational video service provided by WGBH-Boston. WGBH produces many of the best-known programs on public television, including "Zoom" for children, the history program "American Experience," and the science program "Nova." Teachers' Domain is WGBH's digital library for K-12 classroom use and independent study. Myers took an on-line course from Teachers Domain last spring that showed how to integrate video and other media into various science lessons. "What I typically do now is use streaming video from Teachers' Domain within a Powerpoint presentation," she says. "I can go from talking to showing a video clip to leading an activity seamlessly."

Myers recently taught map skills in this new way. "I used to pull a map down from the wall and stand in front of it while I talked," she says. "Now I show different maps while I talk, and after a few minutes of talking I show a video clip. The children have globes at their desks so as soon as I pause they can start doing exercises." One of the video clips is a segment from "Zoom" that shows a brother and sister from Shonomish, Washington navigating their way through an orienteering course. The boy explains how to use a compass and a map to set a course, and the camera shows his younger sister running through the woods from one checkpoint to another. After the clip is over, teachers can use additional materials from Teachers' Domain to explain how a compass works, or they can set up a lab so students can make their own compasses.

"Every year the children are different," says Myers, "but so many of them are growing up in a video-saturated world that it's

foundation. There's an old saying, 'people teach the way they were taught.' If you were taught math by listening to lectures full of boring facts,

Eastview Elementary in Olean, New York for 11 years. "That has certainly changed."

hard to keep their attention by just talking. With these clips, I can mix it up and vary the pace. It holds their attention better than the old way did." ■

Eskeletons: No Bones About It

By Brad Edmondson

A team at the University of Texas has combined new technologies to put a world-class bonelab on your laptop.

An online skull representation is created from a Quicktime movie of a rotating human cranium by analyzing an actual cranium with a surface scanner, which rotates a specimen on a turntable while using a laser to capture its topography.

The instructor takes a human skull and slowly rotates it, so you can see every part. Then he tips it up and rotates it again, giving you a view of theoccipital bone and the holes that connect the brain to the carotid artery, jugular vein, and spinal cord. You point to different sections of the cranium and the instructor tells you their names. Here is the vomer, the thin flat bone that separates the nostrils; here is the zygomatic arch beneath the eye socket, which supports the brain while it anchors the jaw. Next the instructor shows you cross-sectional X-rays of the skull so you can see how tough the zygomatic is. There is a honeycomb of bone tissue inside, making it both lighter and stronger than a solid mass. Then he shows you the skulls of a gorilla, a baboon, and a spider monkey and invites you to make comparisons.

You could be in one of the few anatomy labs in the world that has such resources. But it's more likely that you're visiting eSkeletons. Since this web site went up five years ago, anyone with a computer and an Internet connection can have this experience at any time, free of charge. The site is an example of the exciting things that happen when online learning combines with new technology.

“Most medical students have adequate access to bone specimens, but for others it’s usuallyinadequate,” says John Kappelman, Professor of Anthropology at the University of Texas and the principal investigator for eSkeletons. “Undergraduates have limited access to anatomy labs, and secondary schools are likely to have even less access. When I take boxes of fossils and bones to elementary schools, they’ve never seen anything like them before. The institutions that link to our site go all the way from elementary schools to medical schools.” (*continued*)

Above, left to right the eSkeletons team: Lauri M. Thompson, Eva Garrett, Ashley Gosselin-Ildari, Christyna Solhan with interspersed friends.

Eskeletons (continued from page 1)

When you can compare human bones with bones from other primates, you have lots of applications for teaching evolution.

Kappleman's team began receiving support from the National Science Foundation in 1998. They created the Quicktime movie of a rotating human cranium by analyzing an actual cranium with a surface scanner, which rotates a specimen on a turntable while using a laser to capture its topography. The scanner records each point of light on the skull's surface with a triangulation algorithm to measure the exact X and Y coordinates relative to the fixed position of the laser. After the laser covers the entire surface of the specimen, the data points are expressed on a computer display. Researchers use software to connect the points and make a mesh outline of a skull. Then they use painting and shading software to complete the model. The site has the complete skeleton of a human and 11 other species, including apes, lemurs, a marmoset, and a bushbaby.

On the site, a point-and-click function highlights each part of each bone. The team uses an industrial X-ray machine, or CT scanner, to make the cross-sectional displays. Students with more powerful computers can even use a VRML (ck) display to rotate the bones themselves.

"Some of our non-human skeletons are almost unknown in anatomy labs," says Kappelman. "When you can compare human bones with bones from other primates, you have lots of applications for teaching evolution." He is developing a teaching module that compares the dental characteristics of apes and humans to separate primitive from derived traits.

eSkeletons is in its sixth year and is expanding. "We built the site for undergraduates, but then we got a lot of visits from younger people," says Kappelman. "A sixth grader in South Africa was doing a project on baboons. He had somehow gotten a skeleton and was using our site to describe the pieces. He wrote and asked us to make an image of the baboon hand that showed all of the bones articulated together. We hadn't done that, so we corrected it."

eSkeletons has hired a former elementary school teacher to design a new site that will be more friendly to elementary and middle school students. "We will be making simple classroom activities, like downloading and printing out an entire skeleton in sections so kids can crawl all over it and color it," he says. "That kind of resource would be just as useful in Ethiopia as it would be in Austin, Texas," he says, because access to these materials is scanty in both places. *(contintued)*

Eskeletons (continued from page 2)

We're going to use 25 to 30 forensics cases to show how you can estimate stature, sex, and other characteristics from bone specimens.

The site is also building a section "so you can see some applications of learning about bones," he says. "We're going to use 25 to 30 forensics cases to show how you can estimate stature, sex, and other characteristics from bone specimens. We will also build out the site to teach statistical methods. You could measure 20 different baboon femurs and enter the data to calculate means, coefficients of variation, and the standard deviation." Kappelman's team also has a 3-D printer that uses the data points from scanned bones to manufacture highly realistic scale models – as many as needed.

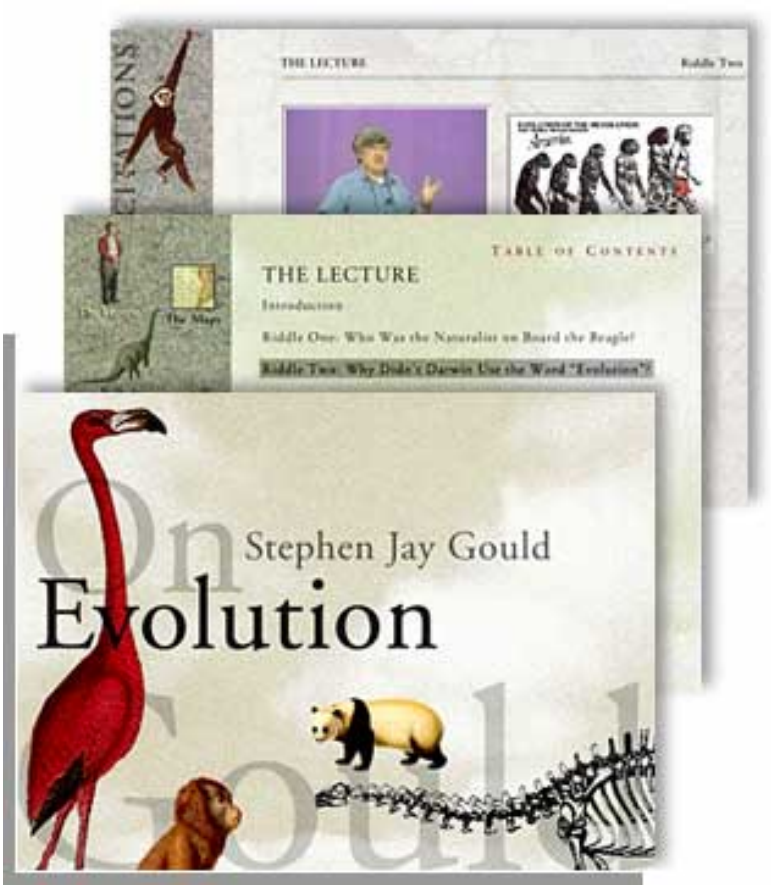
Kappleman does not yet track the ways teachers use eSkeletons, but the users are out there. Audrey Kittredge, who teaches advanced biology and environmental science courses at Chittenango High School in Chittenango, New York, is developing an eSkeletons application as a Master Teacher in the NSDLSun program. The program unites a group of teachers who use the resources of Syracuse University to build new teaching tools. "It's great to be able to dive into that resource," says Kittredge. "Teachers don't often have the time to collaborate with each other. Here, you can."

Kittredge's group is designing an interactive learning tool called "Doctor Darwin's Notebook" that uses eSkeletons. Students will begin the exercise by making a hypothesis in the form of a tree diagram showing which apes they think are most closely related to humans. Then they will measure the sizes of skulls and other bones on skeletons, make a second diagram based on their measurements, and compare their results to the hypothesis. "The focus is on the processes of science as much as it is on the subject," she says. (see "Websites That Rock" in news section)

"There's no end to this," says Kappelman. "Right now I have four great undergraduates and two graduate students working with me, and ideas are pouring out of them. It's still fun." ■

Books Unbound

By Bob Stein



The first version of easy-to-use multimedia software supercharges teaching and homework. The next version will be even better – and it's free.

In 1981, I had the good fortune to be hired by Encyclopedia Britannica to think about the future of encyclopedias in the digital era. I visited MIT's Media Lab to look at their interactive video projects, and there I saw a new kind of repair manual. On the computer screen was a beautifully designed text and photo of the underside of an automobile. It looked like a page in a book. But when I touched the photo, it turned into a video explaining how to loosen the oil pan. It was the eureka moment. I had seen the book of the future.

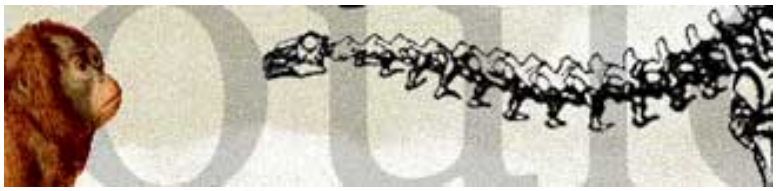
In order to explain the power of this new kind of book to the folks at Britannica, I had to think about what books are really for. My pondering lead me to consider books not in terms of their physical properties – not as ink on paper – but in terms of how they are used. Books are what we now call a random access medium. They give the reader complete freedom to navigate through the contents in any order and at any pace they wish. Although a random access medium's contents have to be created and arranged by someone, the user controls the experience. I began to refer to books as "user-driven media." This is in contrast to movies, television, and radio, which are producer-driven: the maker determines the user's experience. The user passively watches or listens while producer-driven media moves from beginning to end.

In addition to random-access, the user-driven aspect of books enables – and this is the source of their powerful social role as vehicles for communicating big ideas – reflection: allowing the reader to wrestle with the contents until they understand it and then to form their own opinions.

The MIT experiment showed that when you put a microprocessor into an audio/video playback device, you transform traditionally producer-driven media into user-driven media. Users of the MIT auto repair manual could start and stop the video at will, replay instructions until they

understood them, and go back and forth in the program instantaneously, without waiting for a tape to rewind. The MIT team had extended the power of a book to audio and video. They started me on a twenty-year exploration of how books might evolve if they combined text, graphics, audio, and video. *(continued)*

Books Unbound
(continued from page 1)



Students who read original manuscripts have been exposed to vernacular Spanish spoken by children their age in a natural way. A printed text could never achieve this.

At first, this exploration consisted largely of publishing CD-ROMS at The Voyager Company. We did an in-depth study of Stravinsky's Rite of Spring that allowed users to connect the author's ideas with audio clips from the composition. We did a wonderful project that combined a one-hour lecture on evolution by Stephen Jay Gould with the text of 50 of his best articles for Natural History. By the 1990s, however, we realized that the tools available for creating multimedia projects were extremely arcane and difficult to use, and that this severely limited the number of projects we could publish. We started a project to build a new class of authoring tools that would enable creative people to assemble robust and aesthetically elegant projects without hiring a programmer. Ten years later, Night Kitchen Inc. released TK3, a cross-platform (Mac and Windows) authoring environment that makes it relatively easy to create complex multimedia projects.

Since we released it, TK3 has been used to create a dizzying array of work. I have seen fully realized textbooks and course-packs in TK3, along with personal diaries and multimedia artwork. But the most popular use of the program has been for homework. Teachers have been using TK3 as a media processor, enabling their students to express ideas using text, pictures, audio and video.

One of the most interesting projects was developed in spring, 2003 at The Dalton School in New York City. Sol Gaitan, a teacher at the School, created an ingenious learning module for her high-school senior Spanish class. She describes the project as “a portable mini-language lab that targets the multiple language skills involved in the process of learning a foreign language.” Yet TK3 goes well beyond what a traditional language lab offers. For example, Gaitan’s students studied the impact of war on children in Columbia by reading short, handwritten biographies that had been written by displaced children. “With TK3 I give my students scans of original documents, which are a moving testimony of a harsh reality,” says Gaitan. “Then I assign them to do several things. They re-write these documents, correcting grammar and orthography; they translate them into English; and, using links I provide to relevant sites on the Internet, they write an analytical essay on the impact of war on adolescents whose lives are different from their own.

“By reading original manuscripts, they have been exposed to vernacular Spanish spoken by children their age in a natural way. A printed text could never achieve this. They are thrilled by the fact that they are authoring a little book on a topic on which they are becoming experts, thanks to TK3’s easy and direct access to the Internet. For me, the icing on the cake is to have them record their oral commentary in Spanish and include it in their report. This allows me to assess their pronunciation patterns, fluency of oral discourse, and the ability to improvise."

Recently, the Mellon Foundation made a $1.4 million grant to the Institute for the Future of the Book, co-located at the University of Southern California and Columbia University, to develop a completely new version of the TK3 software. TK4 is planned for release in the fall of 2006. It will be completely open source and free to educational institutions, so users can extend the features of

TK4 as needed. Imagine electronic science textbooks that include interactive simulations embedded in the pages. Imagine books whose contents stream over the Internet, rather than having to be downloaded onto someone's machine. Our team is also integrating true-type fonts and style sheets into TK4, and we are enabling time-based annotations that will allow a text window or illustration to open at a specified time; say, 30 minutes and 20 seconds into an audio file. Time-based annotations are particularly versatile feature because they will permit automatic page turning as someone reads a text out loud.

You can see Sol Gaitan's project and other TK3 education based projects on the Institute for the Future of the Book website. If you have any questions or suggestions for features you would like to see in TK4, please write to us. Thank you.

Culture and Communication in NSDL

By Wes Shumar

Why do the most important decisions in building digital libraries happen in face-to-face meetings?

I am a cultural anthropologist, and for nine years I have been doing ethnographic evaluations for a website. I have come to think of this on-line community as my "tribe." The Math Forum is one of the web's oldest educational sites. From the beginning, it has held to a strategy of archiving math problems and good answers to math questions. It has become one of the richest resources available to math educators, over one million pages deep, and it has become a popular place where those who are interested in mathematics can hang out.

A section of this site called Math Tools is devoted to discussions of different topics, and following these discussions is a good way to observe the differences between two tribes who work closely in the field of education: teachers and technology developers. Not long ago, someone at Math Tools posted the following question: "what about a new technology would make it worth using?" A self-described tech person replied that "what makes it worth while is the interest level of the students in using computers…We are increasingly dependent on technology, so that whenever we can incorporate computers in another field it has to be a benefit to the students."

Not so fast, replied a teacher. "Technology is attractive in its own right to some, but it is a barrier to others, so I prefer to see it as an option rather than a requirement," he said. "To me, the fact that computers may only be available occasionally is actually an advantage."

"I should be able to use ANY platform that would best serve my needs," said another teacher. "My challenge is to equip my students with the knowledge, the skills, the 'meta-skills,' the curiosity, etc. to be able to choose their own directions in life. To that end, I am remiss if I don't strive to give them access to every pedagogically valuable tool, technology or otherwise . . . I

would LOVE to give students a problem, then let them choose tactile manipulatives, or their graphing calculator, or a sheet of paper and a stubby pencil, an assortment of textual/graphic materials, or a computer with whatever software they needed."*(continued)*

Culture and Communication
(continued from page 1)

Cultural differences can also be small, and they are complicated by the tendency of individuals to reside in more than one culture.

Teachers, developers, and instructional technologists bring different skills to the table when they collaborate on projects. Teachers are the pedagogic experts, developers are the software experts, and instructional technologists are the mediators who understand both learning and technology. But each of these groups comes from different social worlds. A teacher's day is fast-paced and intense in the face-to-face environment, but e-mail is typically used only at the beginning or end of the workday. A developer's day is fast-paced in a different way with email, instant messaging, and other communication technologies operating constantly in the workspace. Developers also have access to newer, faster technologies than teachers do. These differences lead to different cultural assumptions, different ways of using language, and different ways of thinking.

Anthropologists know that people who tend to do the same things and share in the same practices tend to think about the world in similar ways. The danger that occurs when members of different groups get together is that each group might see members of the other groups as alien. This can lead to what we call "othering," or the tendency to judge someone based upon your own experience of the world. The experience of "othering" can lead to conflict and social breakdown. Teachers get exasperated with developers who care more about what the software can do than with its pedagogical value. Developers get upset with teachers because they are less "connected" and don't keep up with the virtual conversations about a project. We need to understand and bridge these differences if digital libraries are going to become powerful learning environments.

Cultures can be as different as the Maasai tribes of East Africa are from the dominant culture in East Lansing, Michigan. But cultural differences can also be much smaller, and they are complicated by the tendency of individuals to reside in more than one culture. A teacher is part of the culture of her school, but she may also belong to the larger professional culture of teaching, an ethnic culture, and a national culture. When groups of teachers, developers and instructional technologists get together, all of these overlapping cultural differences and similarities intertwine. Research at The Math Forum shows that success in an interactive digital library depends on giving teachers and developers the chance to communicate freely with each other so they can air their differences and create complimentary roles.

During a project called Educational Software Components of Tomorrow (ESCOT), we interviewed teachers and developers and watched their interactions as they built on-line math lessons together. We found that smaller teams did better than larger ones did, and teams that met face-to-face did much better than teams that did not. Face-to-face meetings allow group members to quickly establish different roles, develop clear goals, and choose leaders. Participants also get better information about how flexible different group members are and whether they will follow other members of the group.

The Math Forum has recently expanded Math Tools to allow developers, teachers and others to

contribute software tools to a site, customize those tools, write lessons for tools, review tools and lessons, and hold open discussions. It is a wonderful demonstration of the potential of digital libraries, as well as a possible model for others to follow. But there are things Math Tools can't do. We humans are social animals, and the more complicated tasks of team-building and tribe-forming are much easier when done face-to-face. ■

In Search Of N'ess Dee Els

By Meredith F. Small

Meredith F. Small is Professor of Anthropology at Cornell University.

***N'ess Dee El* society is organized into individual personal altars barricaded by wallboard.**

As an anthropologist, I am often called upon to infiltrate exotic groups and report their odd customs and beliefs back to the real world. One day this fall, my assignment was to contact and observe the *N'ess Dee Els*, which translates roughly as "Those-Who-Know-More-About-This Stuff-Than-You-Do," or maybe "The People," as more polite linguists maintain.

I was interested in the *N'ess Dee Els* because for years they have been hidden away in a remote part of my university campus, and great sacrifices have been made in their honor—buildings, office equipment, holiday parties. When I asked my neighbors what they actually *do*, however, no one was able to explain. I was determined to find out.

My first contact was really no contact at all. When I approached their sacred grounds late one morning, few people had arrived from wherever it is they sleep (*note to myself—caves?—confirm*). "Excuse me," I said quietly over the barrier that separated me from the main staging area, "Is anyone here?" A young female came out of nowhere carrying what turned out to be the tribe's totemic object, which is grasped at all times by everyone. This is a small container full of some sort of steaming liquid which they place on their mouths at regular intervals in salute to some Higher Power. (*continued*)

In Search Of N'ess Dee Els (*continued from page 1*)

I could understand the sounds, and some small words like “that” “be” and “hum” were familiar, but the rest of it was a clearly a made-up lingua computera.

The youngster seemed surprised to have a stranger in the area, but she waved me in with what must be an important symbolic gesture: one hand rubbing the eyes, a big yawn, and a wave in the direction of the inner sanctum. I spent the next few hours wandering around, poking into corners and making notes as people wandered in. What I found was unusual and perhaps disturbing.

N’ess Dee El society is organized into individual personal altars barricaded by wallboard. Each altar is decorated with mementos, pagan symbols, and tiny pieces of glued paper stuck on every possible surface. Many of them had obvious evidence of the tribe member’s particular clan allegiance (such as a mouse, teddy bear, or chipmunk). Some of these clan symbols were wearing hats or bow ties, perhaps in honor of their ancestors.

Piles of sacred scrolls also adorned each altar. These documents were presumably Holy Scripture and meant only for the initiated. I know this because I saw some of the same writing scribbled in color on the walls. Although the alphabet was familiar, I couldn’t decipher a thing: “creating SA thru riz” and “dynamic flbk” meant nothing to me.

Later I discovered that people of this tribe also talk to each other in these codes. “Will that object be repurposed in an open source framework or do requirements indicate an additional IP solution?” I heard one member say to another. “Hum, my embedded librarian swears that's metadata,” she replied. I could understand the sounds, and some small words like “that” “be” and “hum” were familiar, but the rest of it was a clearly a made-up *lingua computera*. Although it would take me months to learn their language and translate accurately, I think they were saying, “I have no life,” and “Me neither.” But I could be wrong.

As I went about my work, several people entered the sacred compound. Some were friendly folks who put down their totemic liquid containers and smiled at me. But most tribe members moved quickly to sit at their personal altars and begin what is apparently their sole purpose in life: to enter into a state that can only be compared to the Hopi “Trance Dance” or the Australian aboriginal concept of “The Dreaming.” (*contintued*)

In Search Of N'ess Dee Els (*continued from page 2*)

But back in the bowels of the community were the aesthetes, those who had completely given themselves up to The Trance.

Before each believer is a square box illuminated from behind (*note to myself—lighted pig fat? check this out*). Once a connection is made, the box and the person become One; what appears to be the contents of the person's mind is displayed on the box, and from that point on, the individual is incapable of looking elsewhere. The person and the box are locked into a mutual mental tango that keeps them from everything, including lunch.

I soon realized that there were, of course, different levels of The Trance. Those toward the center of the sacred grounds seemed to be less connected. They were able to have conversations with each other or pick up a smaller sacred object when it rang and jabber something into it. But back in the bowels of the community were the aesthetes, those who had completely given themselves up to The Trance. They were a group of pale, bearded men hunched over their altars, babbling secret code. They made only furtive glances in my direction.

Obviously, those on the outer ring were aiming toward the inner circle. They, too, seemed to have dedicated themselves to the altars and were sacrificing all to be part of the tribe. I did see faded color snapshots of what looked like relatives, even small children, but the demographic of the group was all adult. Nowhere did I see evidence of a place for mating or childbirth, unless you count the kitchenette out toward the back.

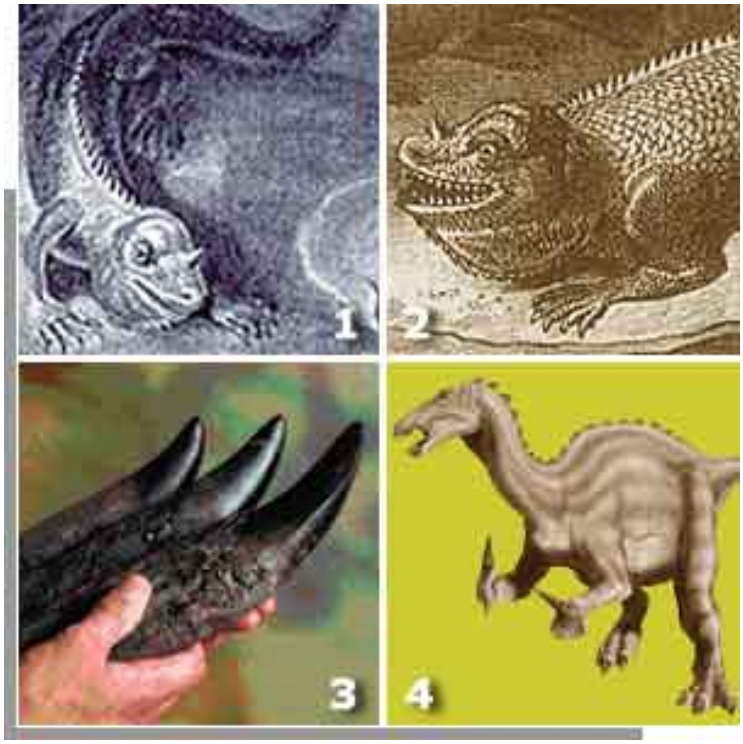
I am tempted to conclude that the *N'ess Dee Els* are a dying breed because they have made a vow to dedicate themselves to The Trance. What disturbs me, however, is the possibility that this tribe has figured out how to connect with each other and reproduce without human contact. In that case, they might be a glimpse of our own future. ■

Q: How do some scientists know (when they are putting bones together) which bone goes where? *Jesse*

A: Most skeletons are very similar, having most of the same parts. By looking at a bone, you can make a good guess about where it is supposed to go by comparing it with bones from other animals. Also, when you fit two bones together correctly they tend to fit very well, like puzzle pieces.

However, paleontologists do make mistakes. Two of the most famous mistakes involve Iguanodon and Brontosaurus (aka Apatosaurus). When Iguanodon fossils were first found, they included large cone-shaped bones that were thought to be horns, like a rhinoceros, so the animal was portrayed with a big horn on the end of its nose. Later paleontologists found that this “horn” was actually part of the animal’s front feet, and it stuck up like a big thumb. In the case of Brontosaurus, the earliest explorers found most of the animal but not the skull. So they added a skull from another site where they had not found any other parts of the skeleton. Only later, when more Brontosaurus remains were found, was the animal’s correct head re-attached to its body.

--Robert Hole Jr., Exhibit Supervisor and Teacher, Lindsay Wildlife Museum, Walnut Creek, California



1. In the 1830s, English scientist Gideon Mantell found a few fossil bones and imagined that an iguanodon looked like this. Source: "Reptiles restored, the remains of which are to be found in a fossil state in Tilgate Forest, Sussex" by George Scharf (1833). Reproduced from the Goof Gallery at Strange Science.

2. Mantell was one of the first to discover dinosaurs. Artists of his era were captivated by the idea of prehistoric monsters. Source: “The Ancient World of Sussex” by George Richardson (1838), from Martin J.S. Rudwick’s book Scenes From Deep Time: Early Pictorial Representations of the Prehistoric World (University of Chicago Press, 1992).

3. Unfortunately, Mantell made a mistake. Later collectors proved that the fossils he thought were Iguanodon horns were more likely to be spikes on their feet. Source: Time For Kids.

4: Paleontologists now saw that an Iguanodon looked like this. Source: The DinosaurIcon.

Dinosaurs And Dark Holes

Anybody can ask NSDL a question and get an answer. Try it!

Anybody can ask NSDL a question and get an answer from an expert. These questions were submitted in March, 2004 from students in elementary school, secondary school, and college. If you have a question for NSDL, go to http://www.nsdl.org/asknsdl and give it a shot.

Ask NSDL Highlights:

Dinosaurs

Scorpions

Dark Holes

Q: How does the poison in tarantulas and scorpions produced? Is it fatal to humans? *Kevin*

A: Tarantulas and scorpions produce poison in a way very similar to the way we produce spit. They have specialized glands that create and excrete the chemicals. Tarantulas, like other spiders, inject the venom with a bite through their fangs, while scorpions inject their venom using a stinger located at the end of their tail.

The only poisonous scorpion native to the U.S. is the Bark Scorpion, shown here as a female carrying young "scorplings." Source: The Arachnology Home Page

Tarantula bites are not considered to be "deadly" to humans, and most species sold in pet stores are gentle and unlikely to bite unless severely provoked (as in bonked on the head!). There are, however, a few species that are somewhat more aggressive and have more dangerous venom. Examples of these are Asian Ornamental Tarantulas (Poecilotheria spp.) and African Baboon spiders (Pterinochilus spp.). These can cause swelling, intense pain, cramps, and inflammation around the bite area. The most commonly sold "pet store" species is the Chilean Rose Tarantula. This one rarely bites, and when it does, it hurts about like stapling your hand – it's not a pleasant feeling, but it goes away quickly.

Most scorpions are also not dangerous to people. There are, however, several species that are considered to be deadly, and these come mostly from Africa and the Middle East. Here in the USA, only the only deadly variety is the bark scorpion (Centruroides exilicauda, or Centruroides sculpturatus in older references) that lives in Arizona and other southwestern states. Its bite is deadly only to the very young or the very old, or to people already ill with another disease. Again, the common "pet store" species, the Emperor Scorpion (Pandinus imperator), is not likely to sting. Even when an Emperor Scorpion does sting, its venom is not dangerous to humans.

If you are planning to keep a tarantula or

scorpion as a pet, be sure to read a good book or two on how to care for it. They aren't the best animals to have as pets, really--they don't do any tricks, and they don't come when they are called. But they don't wet on the rug either, so I suppose that is a plus.

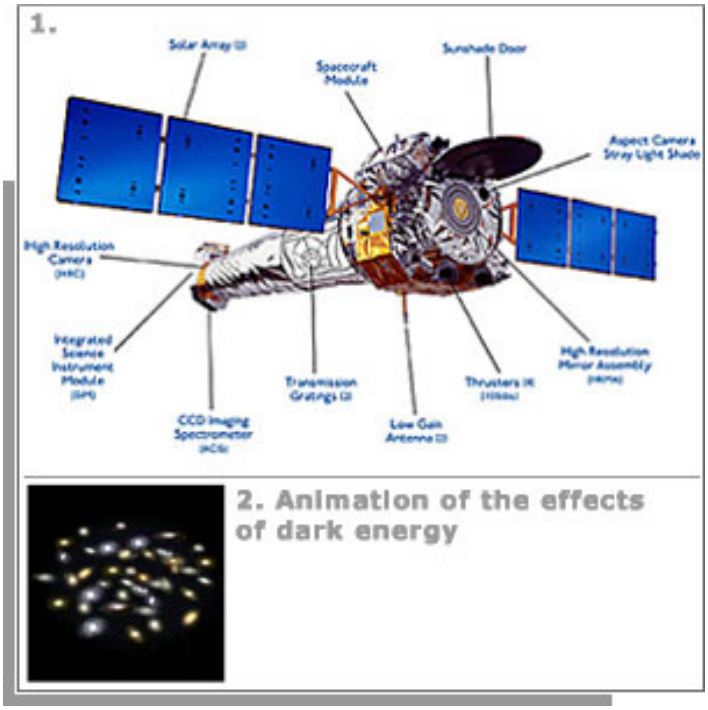
--Michael Weissmann, entomologist affiliated with Colorado State University and consultant for insect zoos and butterfly houses with Kallima Consultants Inc. (see http://www.themicrozoo.com)

Q: If Einstein's theory on the cosmology of our universe is ever proven, would this imply that dark energy and matter do exist? *Preshin*

A: Yes, it would. If Einstein's General Relativity theory is found to be correct, then there can be no tampering with it along the lines of MOND (Modified Newtonian Dynamics) theory to get rid of dark matter or dark energy.

The theory of General Relativity lumps all of the non-gravity effects of cosmology into a term called the "cosmical constant," which we now believe is related to a new physical field -- probably a scalar field, because this type would maintain the relativistic invariance in Einstein's theory. There also seems to be a possibly separate phenomenon, caused by some type of non-baryonic dark matter substance, to account for what we used to call "missing matter" in galaxy dynamics. Taken together, these components allow a simple explanation for what we are seeing in Einstein's relativistic cosmology. There is nothing about dark matter or dark energy that currently violates General Relativity. But if physicists discover that dark energy is produced by some kind of field that is not a scalar field, then this would badly violate the invariance principle.

Only scalar fields can be present everywhere in spacetime, and only this kind of field can be seen as having the same local properties to all observers. If dark energy is due to a vector-type field, then every observer in the cosmos will measure something different for dark energy. This would violate the principle of homogeneity and isotropy, which is at the core of modern cosmology.



1. The Chandra X-ray Observatory was launched by Space Shuttle Columbia in 1999. X-rays are produced in the cosmos when matter is heated to millions of degrees due to such factors as high magnetic fields, extreme gravity, or explosive forces. Chandra is looking for answers to fundamental questions about the origin, evolution, and destiny of the universe. Source: "Labeled Chandra Spacecraft" (72 or 300 dpi JPG)

2. In this 10-second animation, The Big Bang is followed by rapid expansion of the Universe. The expansion then slows down because of the gravitational attraction of the matter in the Universe. But as the Universe expands, the repulsive effects of dark energy become important, causing the expansion to accelerate. Source: "Animation of the effects of dark energy" (1.2 meg low res MPEG)

--Dr. Sten Odenwald , researcher NASA Goddard Space Flight Center and host, Astronomy Café.

Moonshadow

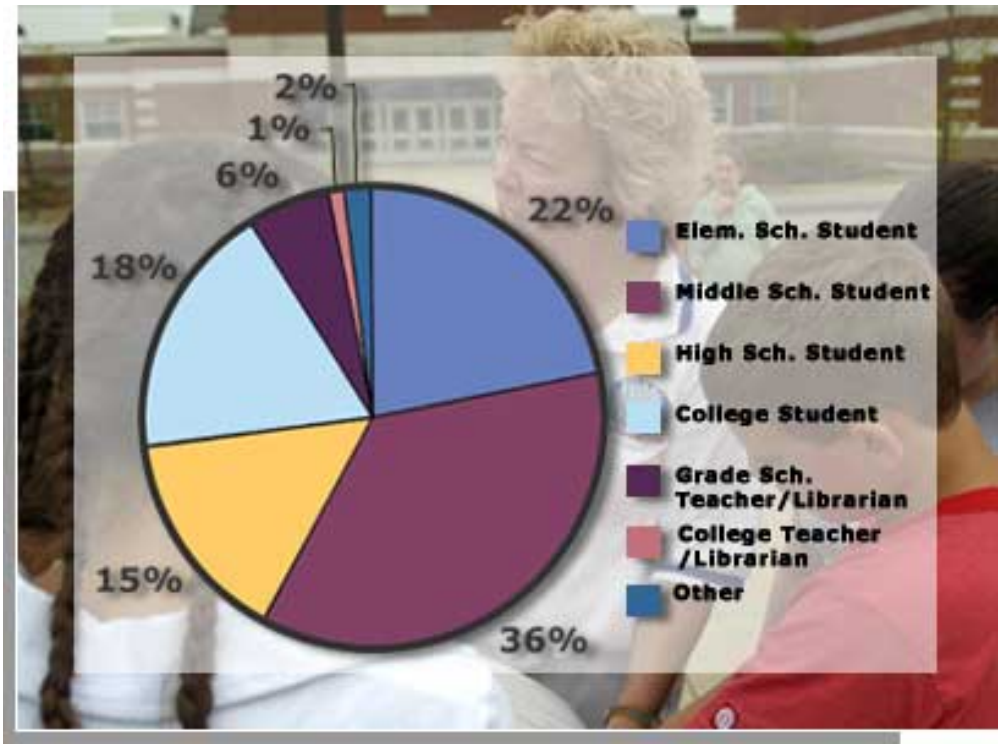
From NASA's"Astronomy Picture of the Day"

This photo shows what the earth looks like during a solar eclipse. The moon's shadow moves across the earth at nearly 2000 kilometers per hour. The photo was taken August 11, 1999 and is one of the last ever taken from the Russian space station Mir.

Source: September 26, 2004 posting

Ask NSDL Users: K to Grad

NSDL's audience is overwhelmingly students, but the students who use NSDL are spread from kindergarten to college.



Learn NSDL

Reader Survey

Thank you for taking the time to answer these five questions about Learn NSDL, the National Science Digital Library's magazine. This information will be used to inform decisions about the future direction of Learn NSDL.

Questions	1	2	3	4	5
1. How well do you think Learn NSDL introduces the NSDL community's energies, activities, and ideas to the wider world? (*1 is very well, 5 is not well*)	○	○	○	○	○
2. How easy is it for you to read this magazine online? (*1 is very easy to read, 5 is difficult to read*)	○	○	○	○	○
3. How important do you think a magazine like this is to the future of NSDL as an organization? (*1 is very important, 5 is not important*)	○	○	○	○	○
4. Please rate the quality of writing in Learn NSDL. (*1 is excellent, 5 poor*)	○	○	○	○	○

Please feel free to add your comments:

Your email (OPTIONAL)

Submit Clear