



Courtesy of Charles Shepard/The Kiski School

Courtesy of the Center for Image Processing in Education

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At far left, a digital picture shows a student in a science class at the Kiski School in Saltsburg, Pa., conducting an experiment. Students at Phillips Exeter Academy photographed a microscopic image, middle, of a porcupine quill. Educators, left, participate in a digital-imaging workshop.

# Digital Imaging Shows New Visions of Scientific Topics

## More science teachers using the technology

BY MARIANNE D. HURST

When scientists first discovered the Archimedes text—a 2,000-year-old manuscript by the Greek mathematician—the task of deciphering it looked hopeless. The mathematician's greatest surviving work, which had been converted into a prayer book, was nearly illegible. But with the help of digital imaging, in which scientists captured 10 digital images of the text under different illuminations, they were able to read it.

The use of such digital-imaging technologies, once available only to scientists and researchers, is growing quickly in science classrooms, experts say. Students and teachers are using digital cameras and other imaging technologies to conduct more sophisticated scientific data collection, lab work, and 3-D imaging.

"It takes data collection to a whole new level," said Gerry Wheeler, the executive director of the Reston, Va.-based National Science Teachers Association. In fact, Mr. Wheeler said, the 56,000-member organization has seen a sharp increase in discussions among its members about how to use digital-imaging technologies in science.

Teacher Web sites covering the uses of digital technology for every facet of the school curriculum—from science to social studies—abound at every grade level. But the technology has given science teachers, in particular, a tool they can use to investigate scientific concepts in much more sophisticated ways.

"It's a new approach to the way we've done science in the past," said Charles B. Murphy, a science and mathematics teacher at the 1,600-student Roosevelt High School in St. Louis.

He uses digital cameras and digital video equipment to teach chemistry, biology, and physics. For example, his students use the digital images they take for projects to measure the size of base pairs in DNA samples. They also use the images they capture to analyze the surface and composition of natural objects, such as seashells. As part of a physics lesson, students take digital pictures of a person jumping, and then examine the images frame by frame to

understand gravity and force.

"People usually say that a picture is worth a thousand words," Mr. Murphy said. "What I try to get [them] to understand is that a [digital] image is worth a thousand pictures. [With a digital image], we can see patterns that are not visible to the naked eye."

### Community Images

Mary Pat Evans—a science teacher at the Londonderry School, a 200-student private school in Harrisburg, Pa., who teaches 5th through 8th graders—says the teaching possibilities for using digital cameras in science are almost endless.

"Technology is a great way to help students achieve," she said. "You'll get kids more interested in what they're learning by getting them involved in a community project using a camera rather than studying a textbook."

For example, she uses digital cameras to teach her students about weather systems. Students take daily pictures of the area just outside the school, upload them to a computer, and use the data to estimate visibility, study clouds, and predict weather patterns. Ms. Evans is working on a project in which students photograph images of their local areas to record changes in the seasons. The images are then uploaded to a Web site and shared with schools in South America and Europe.

Her students have also worked with professional archeologists on a local excavation near the Susquehanna River, where they recorded digital images of Native American tools and artifacts.

Another group of students worked with the local police to investigate an old urban legend that claimed that drug dealers tossed sneakers over power lines to mark their meeting sites. The students photographed 37 pairs of sneakers that had been thrown over power lines around the city, coordinated with police to learn the locations of recent drug busts, and then used a global-positioning system to map the locations.

But while many educators are excited about the benefits of using digital-imaging technologies in the class-

room, skeptics are quick to point out that the technologies can easily be misused. Some voice concerns about the appropriateness of the images students are taking with digital cameras.

Another point of contention is the cost of the technologies.

And some experts say many teachers aren't properly trained in the use of digital-imaging technologies.

Still, the science teachers interviewed by *Education Week* said that a majority of their students who used digital cameras became more engaged and interested in their studies, retained scientific concepts and skills better than their peers did, and learned important management and planning skills.

Even so, some said that finding the

room and what he was doing. The images, he said, allow him to understand better whether the methods he uses are working and if students who need help are receiving the proper attention.

Rob Lindstrom, the executive director of the Pasadena, Calif.-based Digital Exploration Society, runs a program that engages middle school students in digital expeditions in science and other subjects. He said that schools need to be more willing to use the new imaging technologies.

"It's not about taking pictures," he said. "Digital cameras are powerful tools when integrated with other types of technology. These kids are exploring new ways technology impacts the way we learn and communicate."

### 'Personalizing Education'

David Doty, a former high school science teacher, began using digital-imaging technologies 10 years ago. Now an educational specialist with ClearOne Communications, a Salt Lake City-based company that manufactures Flexcam cameras for schools, Mr. Doty said technologies such as digital cameras are enticing more students to be interested in science.

For example, he said, a student can use a digital camera to calculate the area of a leaf that an insect has eaten, to study the growth of mold or bacteria, or to examine the growth of a turkey from the time it was an egg to when it becomes "a turkey dinner." "What teachers have found is that when kids capture their own images, the learning curve goes up," he said.

Traditional science labs, Mr. Doty pointed out, put both teachers and students into a routine in which every student examines the same object under the microscope, then draws and labels the parts on a photocopied sheet. The teachers get 150 copies of the same information.

By contrast, when students take their own digital pictures through a microscope, "it forces them to do a little more research," Mr. Doty said, "because they have to look at their own image, and not a picture out of a book. It's personalizing education."

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Gerry Wheeler

Executive Director  
National Science Teachers Association

time to learn how to use the equipment, set up the software, and plan out lessons can be a problem.

"There are only so many hours in a day," said Charles Shepard, a biology teacher at the Kiski School, a 200-student private school in Saltsburg, Pa. "[Teachers] have the desire to improve and use technology, but you need the time."

He uses digital cameras, but maintains a more traditional classroom atmosphere because he doesn't have the time to go beyond the curriculum. His students use cameras to record the step-by-step procedures they perform during science laboratories, such as the correct way to transfer bacteria from one test tube to another. Those images are used as visual references.

Mr. Shepard also uses the images students take of him or that he takes of the class to assess his own teaching performance. He looks at student expressions and body language to see if he had students engaged in the lesson, and reviews where he was in the class-