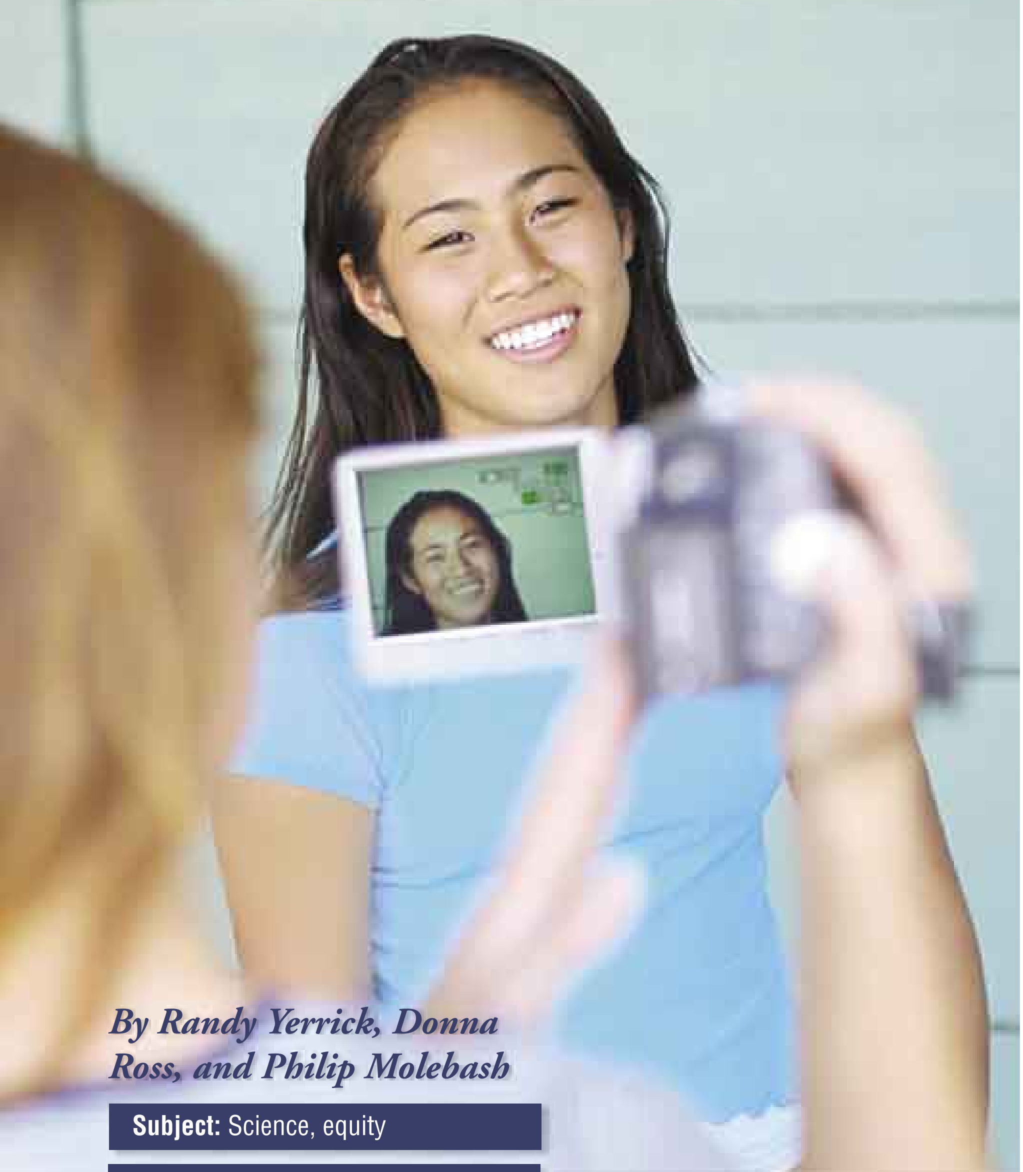
Promoting Equity with Digital Video



By Randy Yerrick, Donna Ross, and Philip Molebash

Subject: Science, equity

Audience: Teachers, teacher educators

Grade Level: K–12 (Ages 5–18)

Technology: Internet/Web, digital video tools

Standards: *NETS•S* 3, 4 *NETS•T* II, IV (http://www.iste.org/standards/). *NSES* Grades K–12 A–G (http://books.nap.edu/html/nses/html/).

Technology can demonstrate varying scientific strategies, which can be extremely successful in making science accessible to a diverse population of students.

Digital video provides a great way to engage children in science. Digital video enhances certain central scientific processes—planning investigations, using high and low speed observations to collect data, controlling variables, and communicating findings from scientific study. (See "Lights! Camera! Science?" in the November 2003 issue of *L&L,* pp. 18–21.)

A second major strength of digital video as a technological innovation lies in its ability to invite multiple voices and representations of students into the process of learning science. This issue is of utmost importance to the field of science education because as both of the most influential reform documents (Project 2061 and the National Science Education Standards) have stressed, science is for all students.

The relatively new technology of digital video editing addresses specific perplexing issues in science education by authentically engaging children in science through their roles as writers, directors, and editors of their own video productions. We discuss how to shine new light on difficult science concepts while also engaging all students in the process of learning science.

Demanding Equity

Many have long maintained that particular groups of students, often white, affluent males, are better prepared to participate in the written and oral discourse found in science classes. This is no surprise considering the well-documented history of the origins of the nature of science itself and its bias toward white, male, upper middle-class norms. We mustn't be content with this disparity. The most significant difference between the national reform recommendations of today and those of the past is the demand for equity in science classrooms. Digital video invites different modes of engagement and appeals to different learning styles, which in turn opens the door for a wider variety of children to succeed in science.

Research in science classes has found that girls receive less positive reinforcement and less of the teachers' attention, are asked fewer complex questions, get less remedial help, and volunteer less in class than boys. Many of these same findings are true for children of color, both boys and girls, when compared to white, middle- or upper-class students.

Developing and editing scientific digital videos is highly motivational and allows students to share scientific understandings and explanations in a small group prior to presenting to the larger class. The planning period is particularly appropriate for English language learners because it provides opportunities for rehearsal of unfamiliar language and syntax. The videotaping and editing of the presentation allows students to hear and see their mistakes and to correct them before they present to the entire group.

Staging the Production

To complete a digital video science project, students must plan and execute several stages of production, including composing, shooting, and editing.

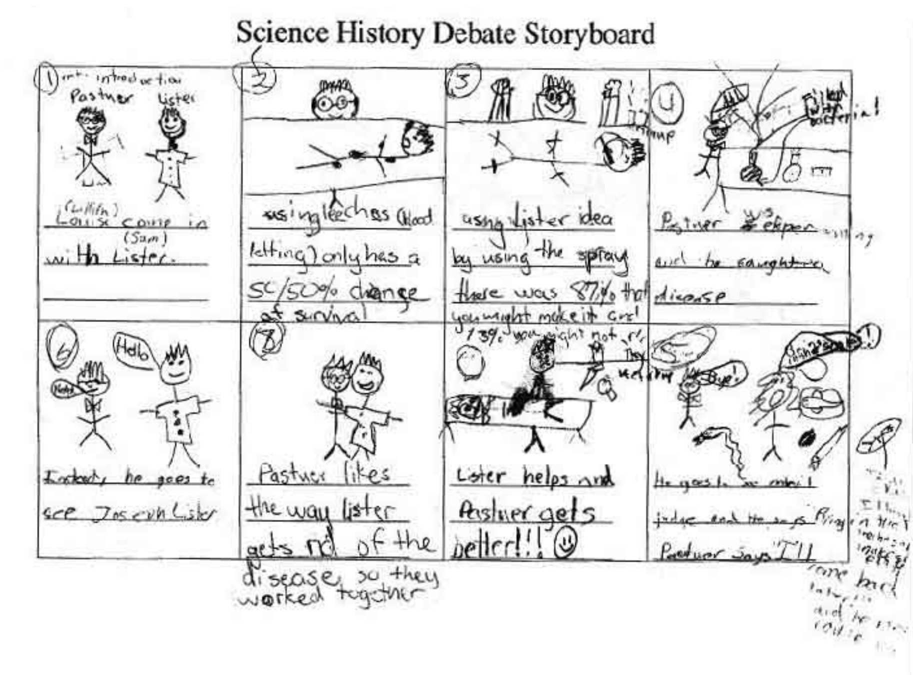
In the first stage, students must plan their project using a storyboard. For example, if students want to write a report about a famous experiment or the impact a specific scientist has made on the way we think about and do science, a written report may not suffice. Role-playing and introducing actual physical evidence may be required to tell the story well. Inserting these into a concise report is no easy task. Students must think carefully about how to integrate spoken scripts, digital images, and data into a completed storyboard. They plan their desired camera angles, making storyboards that include specific edited lines, drawings of settings, example events, data, and any specific camera effects (e.g., zooming, panning). Only after students complete and successfully pitch their stories to their peers and teacher, should they be given the required equipment.

The next stage involves collecting the actual video. This is usually split into shooting footage for an A and B roll (digital video tapes). The A roll refers to central footage used in the storyboard. The B roll usually refers to shots such as the backdrop, secondary angles of the takes, or even shots of the shooting itself for use in productions like those found in "the making of" films.

During this stage, fundamentals such as lighting and microphone selection can make or break the quality of the production, so teachers should help students select equipment and determine camera angles.

It is during the facilitation of filming, acting, and editing that specific skills and characteristics of diverse learners can be highlighted and best used through a collaborative process. Some students love to be funny and others attend carefully to details. Some students are very creative and others like to operate technology. Thoughtful selection of groups and task design can assist all students in having an important and vital role in the learning process—thereby including a diverse set of learners in an authentically engaging project reaching far beyond the capabilities of any traditional assignment or written report. In this way, digital video projects can traverse learning style and gender gaps in science through collaboration in heterogeneous groups.

In the final stage—the editing process—students cut, crop, and add special effects and titles to their work. A and B roll clips are kept on separate rolls because they are imported at different stages of the editing process. During the initial compilation of the project, students bring in core A roll clips that follow the chronology of the storyboard; B roll shots are used when an enhanced effect is required



In this storyboard, girls have taken the limelight in science as they perform the roles of Sir Joseph Lister and Louis Pasteur.

to develop the story. Multiple angles of a single event would be an example of when B clips help tell the story in more engaging ways. In this final stage, the major topics that separate the story can be added through titles and other visual cues to assist the audience in the organization of ideas. Students can also add such special effects as voice dubbing, sound effects, slow motion, ghost trails, or a variety of other enhancements that assist in the delivery of the story.

The experience of choosing relevant video clips; writing, rehearsing, and taping their explanations; and identifying the key concepts and supporting evidence to make a successful presentation is directly aligned with the recommendations for improving communication in science. Planning, rehearsing, presenting first in small groups, and having adequate time to reflect on the content are particularly important strategies to lower the affective filters of English language learners and permit them to participate more fully.

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Recognizing Science Around You

Part of the challenge of achieving equitable science learning for students is connecting abstract scientific concepts to the everyday experiences of those from culturally and linguistically diverse backgrounds. Research findings suggest that many students of color do not consider science as a career opportunity and have not been exposed to scientists who look like they do. Students from diverse cultural backgrounds often do not think of everyday activities or cultural knowledge as including aspects of science. Everyday science assists students in making sense of the world in powerful ways, but is rarely viewed as valuable by science students. Instead, students frequently think that scientific knowledge must be verified in books or by some specific scientific method to be reputable.

Students can use digital video to interview people in local communities to recognize how science is vital to everyday life. Examples of science that students found in their local communities and captured on video include clips of siblings caring for pets, grandparents using local plants to reduce inflammation, parents trying different positioning of fans and plywood barriers to direct heat from the stove throughout the apartment, and friends experimenting with fences and ramps to get the most “air” on their skateboard jumps. Though these interviews demonstrate informal uses of scientific knowledge, students began to see themselves as scientists.

In addition, they created digital video science autobiographies in which they made explicit the ways they use science themselves. To begin to explore future job possibilities, the students also interviewed adults in the community who have careers that require science. Through the process of editing the videos, the importance and ubiquity of scientific concepts were reinforced. This learning supports scientific literacy for all students, regardless of their background experiences or their final career choice. (***Editor’s note:*** See Projects in the Resources at the end of the article for Web sites containing examples of science from the perspective of children.)

Closing the Gap

Lack of common background experiences widens the gulf between those who succeed in science education and those who are left behind. These inequities are perpetrated, in part, by poverty. Parents in low-socioeconomic communities do not necessarily have the time, financial resources, or personal knowledge to fill in the gaps in their children’s science education.

Children growing up in poverty have few opportunities to engage in activities away from home or school, and they have more limited resources around their homes for authentic science-related play. In some neighborhoods, it is unsafe for children to spend time outside of their apartments. Digital video can be used to provide more equitable access to background knowledge.

In the urban schools of southern California and the rural schools of North Carolina, you can find children who live near the ocean but have never been to the beach. Digital video of the geological formations along the local coast, of the animals found in the tide pools, and of the plants that can survive in the harsh, highly saline environment of the salt pannes can be used to develop prior knowledge and to prepare students for a field trip, or they can be used as resources for students as they study and develop presentations. In the hands of competent and equitably responsible science teachers, digital video can be used to provide common experiences for children from diverse backgrounds.

In some instances, teachers try to introduce a scientific concept based on background experiences few children have had. Abstract concepts such as the orbital paths of the moon and Earth and the resultant seasonal patterns and moon phases would be easier to understand if the children could travel to distant parts of the world as part of the unit. Several examples of such virtual field trips and experiences are posted online. Through an institutional collaboration, children in San Diego, California; La Paz, Baja California Sur, Mexico; and Barrow, Alaska, are now able to view digital video of each other in their own environments during different times of day throughout the year. The differences in day length, temperature, and biotic life are much more meaningful when viewed in this context than when simply read from a text.

One especially noteworthy example was the video collaboration comparing east and west coast estuaries. During this project, students learn about their local habitats as well as the contrasts between their local ecosystems and those from more than 2,000 miles away. Throughout this collaboration, students were able to consult experts online who also could share in the virtual video experiences of the students. Students drew conclusions not only about their learning outcomes but also how they were connected to the larger issues and concepts presented in a global ecology. An exceptional supplemental benefit of such projects is that students who have never experienced such field trips are no long prohibited entirely from participating. As long as their schools are connected to the Internet, students can partake in these shared activities edited by classroom teachers and posted as compressed digital video projects—thus making science for all students an even closer reality.

Recommending Change

High-quality science education must include active engagement in scientific investigations, an understanding of the nature of science, effective communication of science, development of testable questions and experiments, and recognition of the relevance of science to everyday life. Few would deny that these calls for reform require teachers to rethink and fundamentally change some of their approaches to teaching science.

Large gaps are forming between middle- and upper-class English-speaking students and the rest of the students in this country. Teachers can preempt the gap among diverse learners through science instruction in the elementary schools. More importantly, science must be made accessible to all students. When science is made more accessible, whether through digital video editing or other innovations, the hands-on nature of science inquiry encourages English language learners to become active participants. Therefore, science can also provide a context and motivation for literacy development as well.

As with any educational technology, desktop video editing cannot respond to all of the challenges that teachers face. The previous examples show how the use of digital video can support effective science teaching and learning. Examples such as these are essential not just for the purpose of varying strategies in science but for making science accessible to a wider population of students.

Resources

Access, Equity, and Gender

Becker, H. J. (2000). Who's wired and who's not: Children's access to and use of computer technology. *Future of Children*, *10*, 44–75.

Goldman-Segall, R. (1998). Gender and digital media in the context of a middle school science project. *Meridian, 1*, 1–12.

Orenstein, P. (1994). *Schoolgirls: Young women, self-esteem, and the confidence gap*. New York: Doubleday.

Projects

Apple Digital Video Showcase: http://www.apple.com/education/dv/showcase

Apple Learning Interchange: http://ali.apple.com/ali_sites/ali/ilife.shtml

Science

American Association for the Advancement of Science. (1990). *Science for all Americans: Project 2061*. New York: Oxford University Press.

Crawford, T., Kelly, G. J., & Brown, C. (2000). Ways of knowing beyond facts and laws of science: An ethnographic investigation of student engagement in scientific practices. *Journal of Research in Science Teaching*, *37*, 237–258.

Greenberg, R., Raphael, J., Keller, J. L., & Tobias, S. (1998). Teaching high school science using image processing: A case study of implementation of computer technology. *Journal of Research in Science Teaching*, *35*, 297–327.

Lemke, C. (1990). *Talking science: Language, learning and values*. Norwood, NJ: Ablex.

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Randy Yerrick is a research associate and science methods instructor for the Center for Research of Math and Science Education at San Diego State University (SDSU). As an Apple Distinguished Educator, Randy spends much of his time volunteering in K–6 environments teaching science content and processes through state-of-the-art technologies and innovative strategies. View his work with children and digital video at the Apple Learning Interchange at http://ali.apple.com/.

Donna Ross is a science teacher educator in the College of Education at San Diego State University. As a research associate in the SDSU's Center for Research in Mathematics and Science Education, Donna is intimately involved in the teaching, mentoring, and research of elementary teachers in southern California. Donna's specialization is in the area of integrating science and literacy.

Philip Molebash started teaching educational technology in the fourth grade, when he was put "in charge" of teaching the teachers how to use the school's new Apple II. Now, as an assistant professor of educational technology at SDSU, Philip spends most of his time working with science and social studies teachers. He is currently the project director for the Digital Historical Inquiry Project, a U.S. Department of Education–funded grant empowering teachers to make effective uses of digital primary source materials.

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