Meaningful Connections

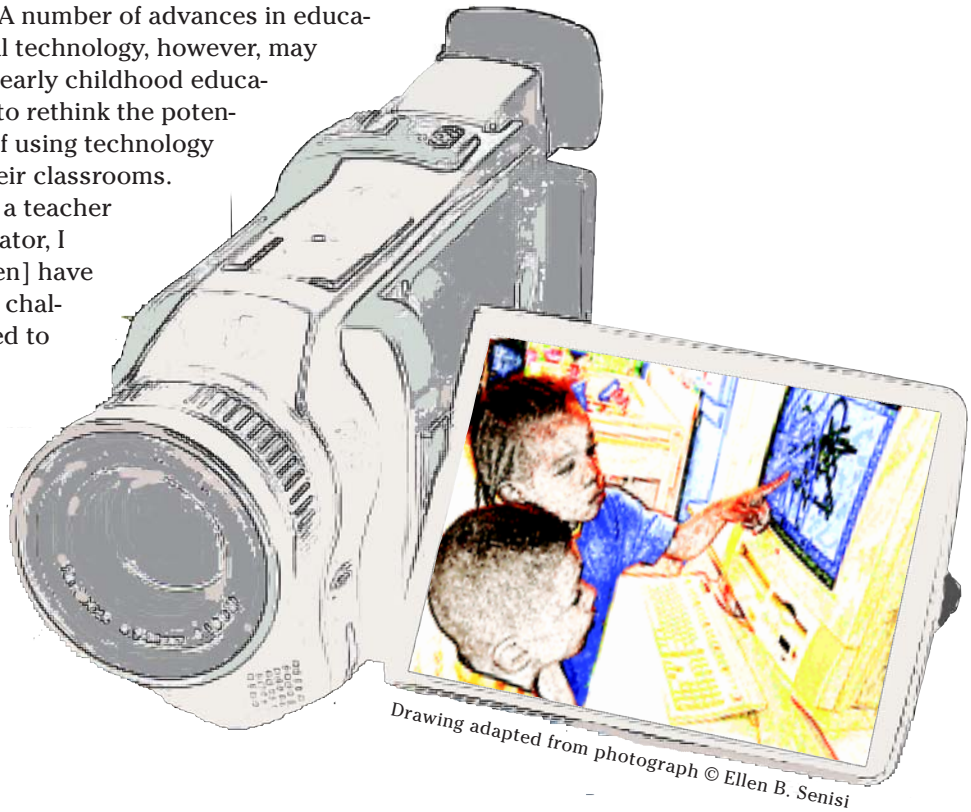
Using Technology in Primary Classrooms

Karen L. Murphy, Roseanne DePasquale, and Erin McNamara

There is no question that technology has become a common element in most children's lives. Many school systems and child development programs have incorporated into their curriculum opportunities for children and teachers to become familiar and comfortable users of technology as a learning tool. At the same time, others in the field have been ambivalent or even skeptical about the use of educational technology in early childhood classrooms.

Visions of programmed instruction and electronic worksheets have caused teachers to fear that children will miss out on key experiences that support their development if computer technology infiltrates teaching. These concerns are not unfounded, as many of the most popular software programs for young children do indeed emphasize rote learning and drill and practice at the expense of more developmentally appropriate methods. A number of advances in educational technology, however, may help early childhood educators to rethink the potential of using technology in their classrooms.

As a teacher educator, I [Karen] have been challenged to



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find ways to help my students, future teachers of young children, learn to use technology effectively in their practice. Many of them come with a wealth of skills in using technology in their own lives, both personal and professional, while others have limited experience and a fair amount of fear and reticence. In the graduate early childhood curriculum course that I teach, a number of students have found innovative and exciting uses of technology to enrich children's learning.


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In this article I introduce some of the broader issues around using technology with young children. I then describe practices some students used to meaningfully incorporate technology into the integrated science curriculum they developed and implemented while student teaching. Coauthors Rosie and Erin describe their own experiences with integrating technology in their classroom science units. The examples discussed relate to early childhood science curriculum, but all of the applications can be used in other areas of the curriculum as well.

Technology's place in the classroom

For technology to fulfill its promise as a powerful contributor to learning, it must be used to deepen children's engagement in meaningful and intellectually authentic curriculum. After all, technology is a tool, and as such it should be selected because it is the best tool for the job. Technology can be a particularly effective tool for English language learners and can enhance the participation of children with disabilities. Teachers, in accordance with curriculum standards, must decide what children need to learn and do and then choose from a repertoire of teaching practices to help children reach these goals. Technology applications should be among the many tools at teachers' disposal to offer children meaningful learning opportunities. At the same time, children need to learn to use technology in the same way they learn everything else, in their own time and at their own pace.

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Most young children have had limited experiences with technology. They need time and access to develop the comfort, knowledge, and skills for using a variety of technology applications before they can use them independently or for a prescribed purpose. The National Educational Technology Standards developed by the International Society for Technology in Education (ISTE 1998) give a good idea of the knowledge and skills that children should be developing in the early years. They can serve as a guide for choosing programs and applications for children to use.

During the preschool years, children should have many opportunities to explore open-ended, developmentally appropriate software programs in a playful, supportive environment. These experiences will help them to develop the basic skills needed to use technology equipment, such as opening and closing programs, saving and printing documents, and navigating the screen using a mouse. This will help children become confident in their ability to use a computer and will provide the foundational skills needed to use more advanced applications for purposeful work as they grow older.

NAEYC Standards on Technology and Professional Preparation

Supporting learning through technology. Rather than being merely an enrichment or add-on to the curriculum, technology has taken a central place in early childhood programs. [Initial licensure] candidates demonstrate sound knowledge and skills in using technology as a teaching and learning tool.

Appropriate technology, including computer software, digital or Web content, cameras, and other peripherals, can support and expand young children's learning, including (through assistive technology) the learning of many children with disabilities. Candidates display awareness of the benefits and potential risks of technology, as well as issues of economic and gender equity in distribution of technology resources. Candidates demonstrate knowledge about how to combine appropriate software with other teaching tools to integrate and reinforce learning.

Source: Reprinted from "NAEYC Standards for Early Childhood Professional Preparation: Initial Licensure Programs." Online: www.naeyc.org/profdev/prep_review/2001.pdf (see also Hyson 2003).

As children enter the primary years, they can begin to use familiar technology tools as a part of their academic program. At the same time, adults should model the use of technology in support of the curriculum and learning experiences children are engaged in. For example, adults can model the use of technology for communication by using e-mail and word processing programs with children to communicate with families and others important to the classroom community. There are many other ways adults can model appropriate use of technology, such as documenting events in the classroom using digital still or video cameras, creating multimedia electronic portfolios that document children's learning, using informational software or Websites to find the answers to questions that come up in the course of ongoing learning, or working with children to create multimedia slide shows to present to families during open house or parent events. This way, children can see firsthand the purposeful use of technology and benefit from exposure to more advanced applications that they will eventually use independently.

The technology tool kit—Applications that connect to learning

A number of technology applications have potential to support and extend young children's learning. Many of these tools can be introduced to preschoolers for use in a very open-ended and playful way but can then be expanded to allow for more advanced academic work as children develop proficiency. Each of the following applications is demonstrated in the work of this article's co-authors (see "Erin's Experience" and "Rosie's Experience").

Digital imagery, both still and video, is one of the most exciting technological applications for early childhood classrooms. Photography and video have long been used to document children's learning and to help them remember and reflect on their experiences. Advances in ease of use and accessibility, along with reductions in cost of digital imaging tools, have greatly simplified the use of these tools in the classroom. Video imagery has been described as a "tool of the mind" (Forman 1999, 1) that has the potential to help children relive their experiences and process them in deeper, more focused, and more detailed ways. In the case of digital imagery, records of children's experiences can be loaded onto the computer where children can seek them out and review them at will. The images can lead children to discuss the events with adults and peers and then perhaps use them as a basis for writing, drawing, or other forms of processing and expression.

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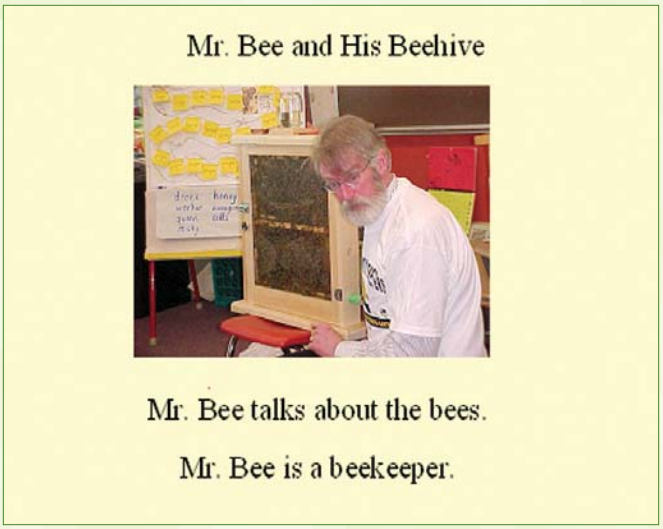
Erin's Experience

The Road from Egg to Bee: An Integrated Science Unit



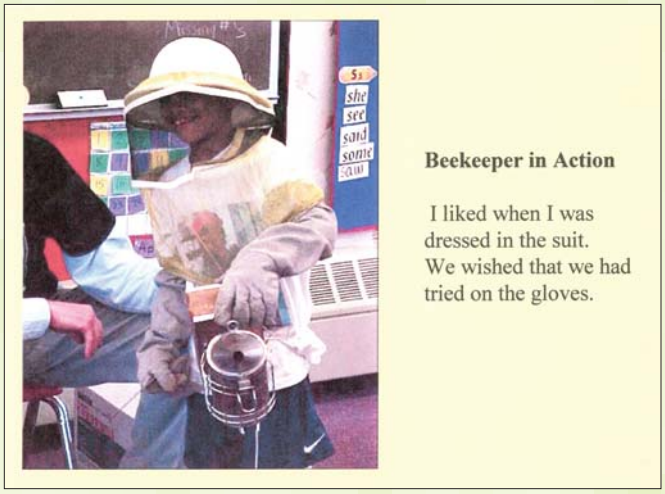
It's a challenge teachers face constantly. How do you juggle a demanding schedule, provide quality care and instruction, and meet curriculum requirements? A convenient choice is to rely on what has been done before or to purchase prepackaged curriculum. Often these methods do not allow for self-discovery, preventing children from unwrapping their education like a present.

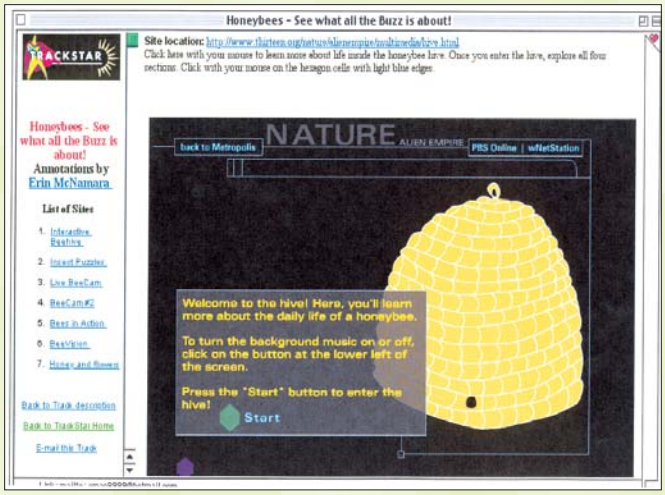
As part of my student teaching in a first grade classroom and as a final project for a curriculum design course, I created an integrated life cycles science unit on honeybees. I chose this insect because many children have had experience with them, either in real life or through stories and television programs.

Young children learn through their senses; having real bees to observe, draw, describe, and represent was a crucial part of the unit. My father, a retired schoolteacher and beekeeping enthusiast, brought an observational beehive to the classroom. The hive provided a safe way for children to experience the live bees and construct their own understanding of the characteristics, habitat, roles, and life cycle of a bee.

By the end of the unit, I expected all children to know that bees are insects and have three body sections. We followed the progression of the bees from egg to adult and learned that bees are an important link in the food chain; many plants cannot make seeds unless bees pollinate their flowers. We also learned that honey is a product of honeybees; humans and other animals consume honey in many forms.

Technology was integrated throughout the unit to support children's learning experiences. Prior to this unit, we primarily used math and literacy programs during our computer lab time. While implementing the bee unit, children used the computer as a reading and writing tool to extend and enrich science concepts and as a presentation tool to showcase a classroom-created Website. We used the Internet as a research and guided discovery tool, focusing on specific bee Websites that I had identified in advance.





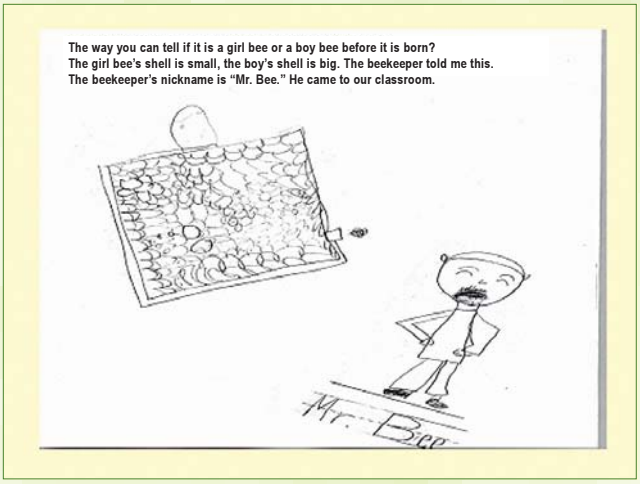
Creating a classroom Website

The use of digital imagery was one of the most useful technology applications in this unit. The school's technology specialist took pictures with a digital camera during the beekeeper's visits to our classroom. The children then worked in mixed-skill level pairs to discuss and write about

(Erin's Experience continued)

three points: (1) who was in the picture, (2) what was happening in the picture, and (3) a feeling or thought they had about what was happening in the picture.

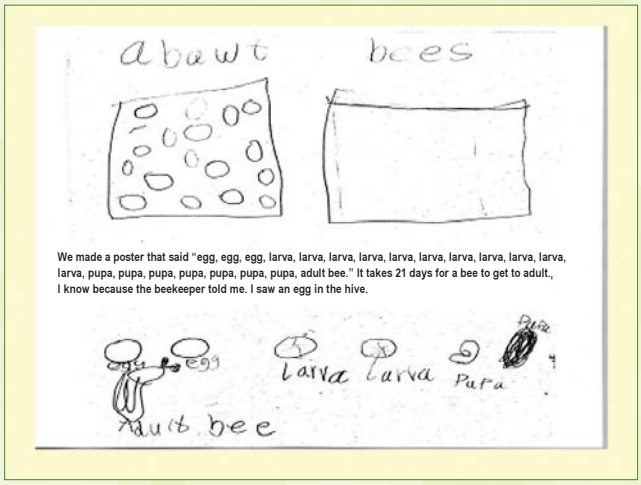
Students then learned to use a new children's word processing program. In their mixed-ability pairs, children worked cooperatively to practice reading and word processing their work on the "writing pad" section of the program. These pages soon became part of our classroom Website. I edited the children's work and matched the text to the photos to make each Webpage. As a whole class, the students brainstormed ideas for the introductory paragraph on the home page. Students also recalled and revisited information learned during the lessons on honeybees by discussing the digital pictures of the beekeeper's presentations.



"Inside the Hive" classroom newsletter

Just as bees work and live together as a community, each week I met with a small group of student "reporters" who represented our classroom community. While I was working with the small group on the class newsletter, the rest of the class was doing independent work such as silent reading or writing in journals. The reporters rotated each week for a month until all the children had had an opportunity to contribute to one of the four issues. Reporters were expected to write about something they learned, something they liked, or something that surprised them. I helped the children make their writing more clear and specific.

I also used the newsletter as an assessment tool to analyze the ways the children communicated their ideas. I noted the use of any insect terms and vocabulary, and the children's ability to use written words to construct complete thoughts. Most important, I was able to gauge how different children processed that week's lesson so I could adapt the content or style of future lessons. As the children discussed how they had learned about bees through the beekeeper's visits and their research, the newsletter continued to reinforce concepts, ideas, and activities.



Guided Internet exploration with TrackStar

If the Internet is an information superhighway then TrackStar (http://Trackstar.hprtec.org) is a road map to help educators organize and bookmark Websites for use in lessons. TrackStar is a national database where educators can search for a track of annotated Website addresses (URLs) by keyword, author, theme, or standard. Each frame has a box at the top of the screen where educators can enter child-friendly directions to facilitate independent exploration and work.

After extensive research, I found seven quality Websites about bees and created a track, "Honeybees—See what all the buzz is about!" (Track #72549). Each page (or frame) of the track related to a different aspect of the bee's life. The children could explore an interactive beehive, watch live bees on a Webcam, experience how the world would look if they were honeybees, and learn why honey can vary in color and flavor. Most important, each frame had specific instructions that engaged children in observing, recording data, making comparisons, and problem solving. This guided discovery continued to reinforce the unit concepts, ideas, and activities.

Technology played a key role in enriching the children's learning by offering a series of opportunities to build upon their growing knowledge of honeybees. Each technology application provided a chance to communicate individual learning experiences throughout the unit.

The most rewarding part of this unit was observing the children making connections with insects or bees beyond the classroom. Through such connections the children were constructing their own knowledge and taking ownership of their learning. I felt a sense of pride about this unit. In turn, I wanted all members of the class to feel this same sense of pride when they shared their newfound discoveries with friends, families, and each other.

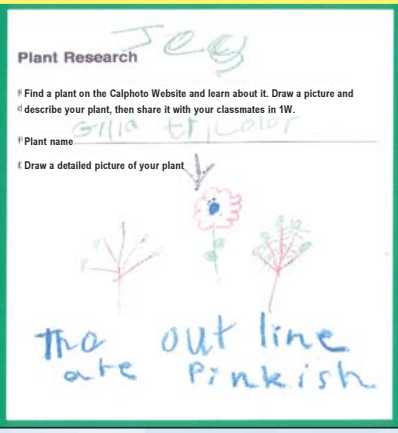
Rosie's Experience

Integrated Life Sciences Unit on Plants

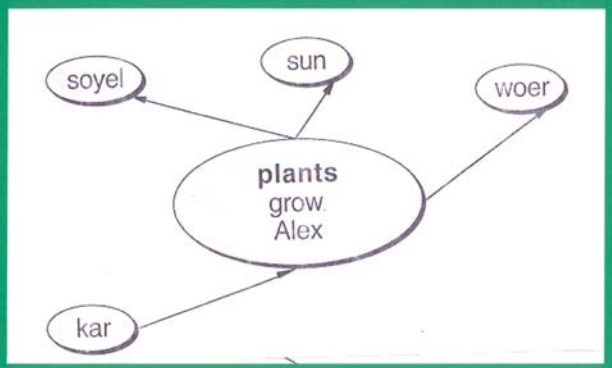
When I set out to create an integrated science unit for my first-graders, I thought the study of plants would be an interesting and meaningful cross-disciplinary program. We explored the seed-plant-seed cycle, beginning with an exploration of seeds and ending with the growth of the seed into a mature plant that produces new seeds. During the unit children could plant, measure, write about, chart, make predictions about, graph, and draw their plants in various stages of development.

By the end of the unit I hoped the children would have a working knowledge of a plant's life cycle, plant parts and their function in the overall life of the plant, as well as what plants need to grow. Another goal was for the children to understand that, as scientists, we explore natural phenomena by observing, predicting, identifying similarities and differences, measuring, describing, discussing, and explaining our investigations.

Students researched and observed different plants on the Web.



Students used Kidspiration software to create a web of "what a plant needs to grow."

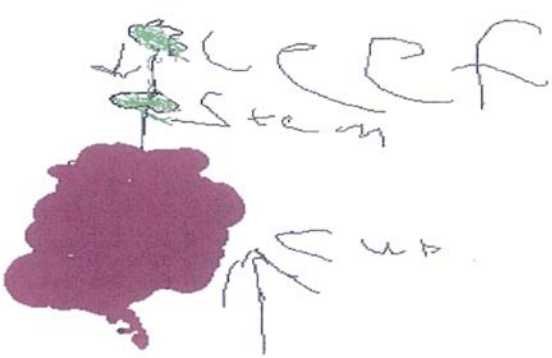


In creating the curriculum for our study of plants, I wanted to incorporate technology in ways that would support and extend the planned science goals. At the time I was fortunate to be teaching in a designated "classroom of tomorrow." This meant that the children had access to five classroom computers in addition to their weekly visits to the school computer lab. For this age group, it is important to integrate technology in a way that provides purposeful, hands-on activities that not only further understanding of the science content but also encourage collaborative work.

Creating webs

Two of the classroom computers had a webbing software program. On one, the children created topic webs showing all the different plants they knew. As the unit progressed, they used the same software on the second computer to create a web of the different plant components we were studying. Both webbing activities let children connect what they were learning about plants to their prior knowledge as well as enhance their webbing skills. I also used both activities as an important part of my ongoing assessment of children's prior knowledge about plants as well as their developing knowledge of the unit content. I was able to see how they used new vocabulary, incorporated new concepts or ideas into their webs, and integrated their existing knowledge of plants with the new information they were exploring.

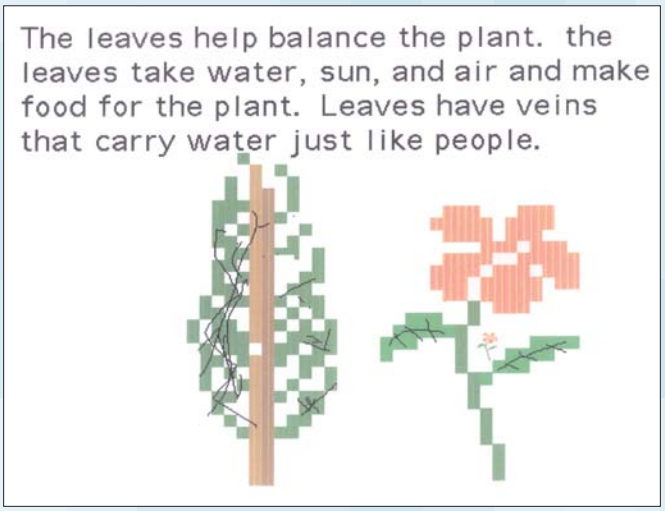
Students used KidPix to draw and label plants.



(Rosie's Experience continued)

Doing research

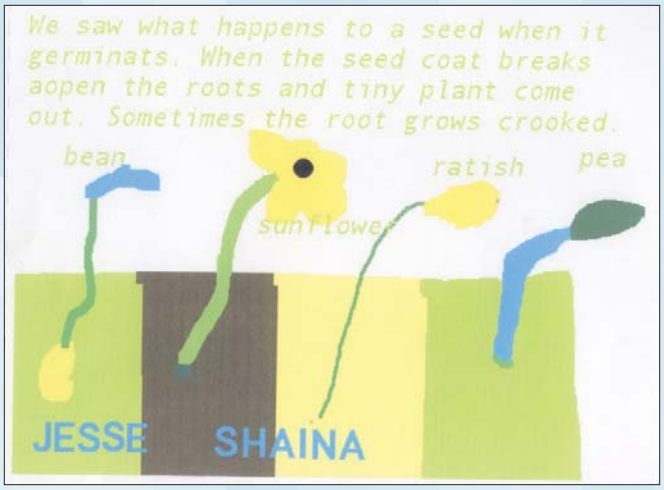
Our third computer was dedicated to the observation of plants in different areas of the world. On their own or in pairs, students used a TrackStar Webpage to research many different types of plants from all over the world and share their newfound knowledge with classmates. The children practiced observational drawing. Once they completed their research, each child drew a picture of the plant he or she had learned about and presented it to the class. Again this activity provided a rich cooperative learning experience that allowed the children to learn from one another.



Representing and sharing what was learned

At another computer, students drew and labeled plants and plant parts using an art program. With this application, children could build on their knowledge of plants and discover new ways to present information to their peers. At the end of the unit, as part of an overall assessment, the class created a slide show titled "What We Learned about Plants." Each child worked with a partner to create one slide that depicted a particular phase of the plant life cycle. Each pair chose which phase they would write about and illustrate. After all of the writing and drawing were complete, the children added voice narration. It was a great comprehensive activity that closed our unit of study.

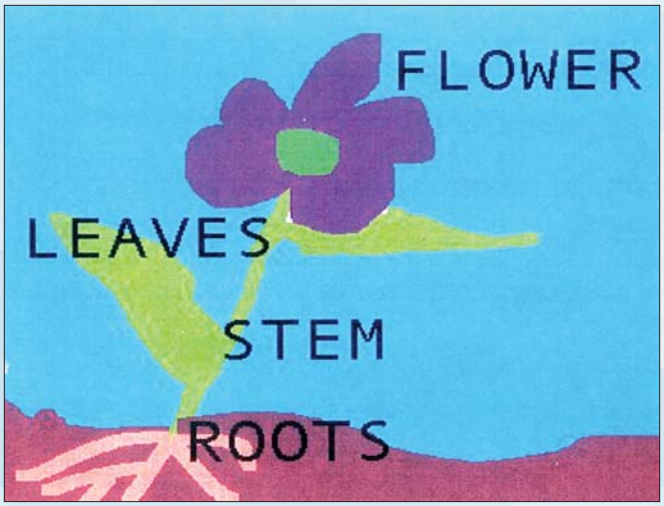
Overall I felt the unit met the goals I had outlined at the start and provided additional experiences with science concepts. In addition, children had many opportunities to cooperatively stretch their technological skills and take

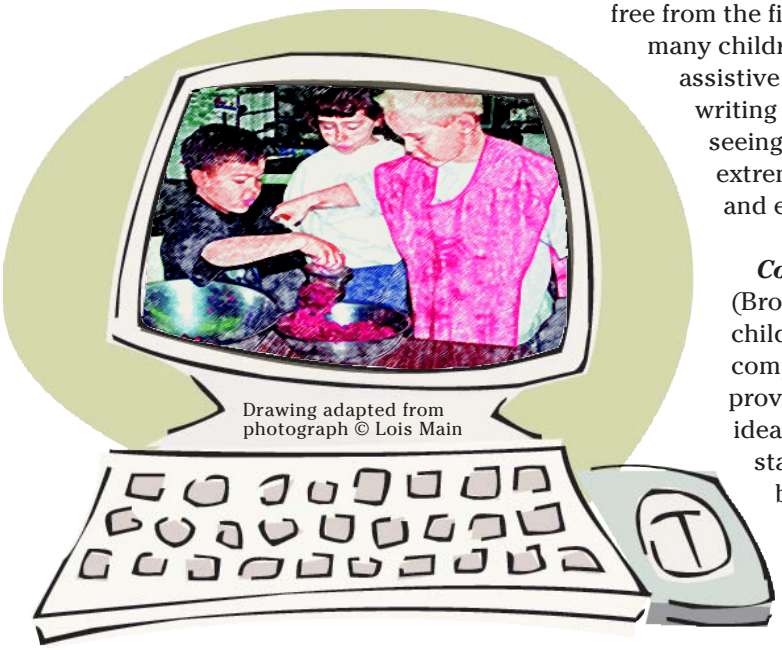


responsibility for their own learning. They had multiple opportunities to construct knowledge, pursue many different aspects of the content, and further their understanding of the science content through the various computer activities.

One of the most successful uses of technology in this unit was the culminating slide show. While I assessed the children's learning with each lesson, I was pleasantly surprised by their knowledge as they enthusiastically recalled important concepts and ideas. They created the title and all of the text. Every student contributed at least one idea to our final piece. The slide show gave the children a hands-on way to share their knowledge.

Many of the computer activities helped enhance the children's understanding of the collaborative nature of science. Students worked together to further their understanding of the content and scaffold one another's learning when necessary.

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Word processing and writing tools, for example, WriteOn (Software Production Associates), allow children to express themselves, free from the fine motor demands of letter formation. For many children these tools can serve as adaptive or assistive technology to make the physical act of writing less frustrating. For others the excitement of seeing their stories and ideas in formal print is extremely motivating and can spur them to revise and edit their work in order to see it "published."

Computer art programs such as Kid Pix (Broderbund) are an excellent way to introduce children to open-ended exploration of the computer. Children's art programs generally provide a wide range of choices for expressing ideas, from freehand drawing to the use of stamps, text, or other special effects that can be combined to create a complex visual display. Many of these programs also provide multimedia options such as sounds, animation, and voice recording to allow children to create multimodal work. Some of these programs are simple enough for three-year-olds to use with ease and have the capability to expand and grow as children's expertise with a program increases.

Preschool children should have many opportunities to explore open-ended, developmentally appropriate software programs in a playful, supportive environment.

Presentation software such as HyperStudio (Robert Wagner Publishing), which is often part of art programs, can allow children to create multimedia presentations that express their ideas, experiences, and understanding to others. Children can create slides in the art part of the program and then import them into a slide show to be shared with others.

Research tools, both age-appropriate Websites and software programs that provide information, such as Nature-Virtual Serengeti (Disney Interactive) and Encarta Encyclopedia (encarta.msn.com/encnet/refpages/artcenter.aspx), can be used formally and informally to research topics in which children are interested. These applications can augment the classroom library and provide multimedia databases on a huge range of topics.

Concept mapping software such as Kidspiration (Inspiration Software) allows children to depict many of the ideas and concepts they are working with and put them in relation to one another pictorially. These tools allow children to create webs and other schematics that visually represent their understanding of a topic. These schematics can be used by children to play with ideas and by teachers to assess children's understanding and thought processes.

Conclusion

Educational technology is here to stay. Over a decade of research has documented the effect of appropriate use of technology in educational settings. These studies provide compelling evidence that computer use can have a major, positive impact on children's social, emotional, language, and cognitive development (Shade 1996; Haugland 2000; Van Scoter, Ellis, & Railsback 2001). Early on, the preponderance of evidence of the potential benefits of technology-enriched curriculum led NAEYC to conclude that "there is considerable research that points to the positive effects of technology on children's learning and development" (NAEYC 1996, 1). The full potential of technology's tools is only realized, however, when they are used effectively and in ways that connect meaningfully to the ongoing curriculum of the classroom and support creativity and critical thinking (Bergen 2000).

It is necessary, therefore, for teachers of young children to be knowledgeable about the range of appropriate technology applications. It is our responsibility as educators to help children understand how to use technology in safe and enriching ways. We need to expose children to developmentally appropriate, challenging, creative, and collaborative uses of technology such as those demonstrated in Rosie's and Erin's classrooms. Children need to be taught how to use these stimulating and exciting tools in ways that promote learning and social interaction so that they will become confident and skilled users of technology as they progress in their schooling and throughout life.

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