Chapter 18

THE USE OF TECHNOLOGY IN LITERACY PROGRAMS

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The three brief scenarios that follow provide insights into a classroom community of kindergarten children who are as comfortable with reading and writing on a computer screen as they are with reading and writing on paper. When the children work at the computer with another child or an adult, they have occasions for socially constructing concepts about print (e.g., directionality, matching speech and text), for gaining insights into functions and forms of literacy, for composing with a word processing program, and even enhancing their social status with their classmates. In part because the centrally located computer adjoins other areas of high activity, the computer is an integral part of the classroom culture (Haughland, 1992).

It is 9:20 A.M. on a cold October morning in Ms. Martin's kindergarten, and the room is filled with the sounds of children working at various centers. Patrick and Dartrell sit side by side in the computer center, which adjoins the sociodramatic play center and the classroom library. They are contemplating a color monitor that displays information about bats (see Figure 18.1). Earlier, during rug time when the children sat together on the floor to begin the day, the two boys had listened to their teacher introduce the unit for the week: "Creatures That Fly in the Night Sky." After listening to the text on the screen read aloud, the boys decide how to interact with the computer to receive additional information, in this in-

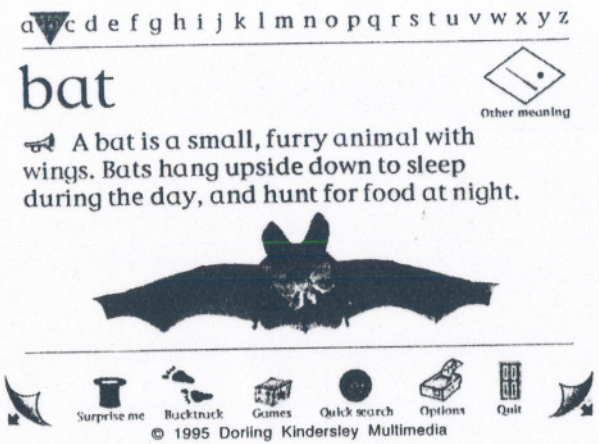

FIGURE 18.1. Patrick and Dartrell learn about bats.

stance an audio rereading of a definition, pronunciations of words that are highlighted in blue, digital drawings that will pop up in boxes over the text, or various sound effects. The boys confer briefly and click on an illustration that also provides the sound of a feeding bat. As Kelly, a classmate, walks by the computer, she stops, looks at the screen, and asks them a question:

KELLY: How did you do that? Get that up there [on screen]?

PATRICK: All you do is . . . Wait (*closes the application*). Like Ms. Martin did. All you do is . . . this (*demonstrates how to click the mouse and get access to the CD*).

KELLY: You're so smart, Patrick. You should be in college.

Word of Patrick's expertise quickly spreads throughout the classroom, and soon other children ask him for a demonstration of how this application works from the CD inserted in the CD–ROM drive of the computer. Patrick's computer ability seems to enhance his social standing with several of his peers, who seek him out for the first time as a reading partner during buddy reading.

A half hour later Ariel and Jasmine sit in the computer center and compare a story book version to an electronic book version of *Stella Luna* (Cannon, 1993). As a "page" of the text is highlighted and read aloud on the computer screen, Ariel points her finger to the corresponding text on a page in the book. Jasmine delights in using the mouse to click on a

screen illustration of one of the main characters, a lost baby bat's mother. The girls watch the animation of the mother bat flying over trees, calling, and looking for her baby, who is lost but safely snuggled in a nest with baby birds. Later, when the two girls use a Stella Luna bat puppet and a bird puppet to retell the story in the sociodramatic play center, they are joined by three other children who serve as an audience. The story innovation they enact is filled with plot twists, melancholy dialogue, humorous events, and voices that sound a great deal like the characters from the electronic book.

During afternoon center time, JaMaris brings an informational book about bats and the Stella Luna puppet with him. He props the book on a small book-size easel that has been placed beside the computer monitor and holds the puppet on his lap. He has decided to contribute to a class book of collected stories on bats. His assignment is to draw and write something about bats using *Kid Pix 2* (Hickman, 1992). As he begins, he is joined for a few minutes by his teacher, who crouches by his side.

MS. MARTIN: So, what's your story going to be about?

JAMARIS: It's gonna be a story about a really cool bat named Spidey and his super powers.

MS. MARTIN: OK. So, how do you want to begin . . . with "Once upon a time"?

JAMARIS: No . . . my name first (*selects the keyboard function and types in the letters of his name using the hunt and peck method*) . . . and I want to draw Spidey.

MS. MARTIN: That's not a bad idea. If you draw it, that bat, you might get some good story ideas. So, what does this old bat look like—like Stella Luna?

JAMARIS: Sorta' like this one but with big green eyes (*pointing to the photograph of a bat on the book cover*). How do I get green?

MS. MARTIN: Remember how I showed you the other day—during rug time? (*Before leaving the computer center Ms. Martin demonstrates how to access the color option from the program's menu.*)

JaMaris uses electronic artist tools to draw a bat with big green eyes, large fangs, and a crooked "B" on the chest (see Figure 18.2). He then writes a two-line story that consists of strings of letters and a word copied from the book cover. He makes two copies using the printer connected to the computer. One is placed in a folder of children's stories that will be bound into a class book, and the other goes into his backpack so he can show it to his mother.

FIGURE 18.2. JaMaris's bat story.

A classroom visitor, witnessing the children's computer work, might assume that they are all remarkably gifted or that they come from affluent homes where they have daily access to computers. However, quite the reverse is true. None of the six children mentioned in these vignettes has a computer at home, all qualify for free or reduced lunches, and all are of considered to be average or below average in their literacy development. The primary reason that the children are adept at using technology is because their teacher consistently plans inviting and enriching computer-related experiences. In Ms. Martin's classroom computer-related learning is meaningful and purposeful and is integrated fully into the daily instructional routine.

Although we still have much to learn about effective technology and literacy instruction in classrooms, research over the last decade (e.g., Fatorous, 1995; Labbo, 1996) provides insights into how to plan appropriate computer-related learning experiences that foster young children's literacy development. In this chapter we draw upon relevant research and underlying sociocognitive theory (Vygotsky, 1978) to offer suggestions for establishing a classroom environment that promotes demonstration, collaboration, and other forms of social interaction. We do so by describing how teachers can use technology to support children's conventional literacy development and the development of what has been called "electronic literacy" (Reinking, 1994).

Conventional literacy development refers to the language arts processes of listening, speaking, reading, and writing that are related to traditional typographic features of linear text, such as print, illustrations, and graphics. Electronic literacy expands conventional literacy to include digital and multimedia materials in these fundamental language arts processes. Others have referred to this expanded view of literacy in other ways. For

example, Flood, Heath, and Lapp (1997) refer to the "visual and communicative arts," and the Vanderbilt Learning and Technology Group refers to "representational literacy," which includes a variety of new media that can be integrated with conventional texts to create meaning.

INTEGRATING TECHNOLOGY INTO THE SOCIAL ENVIRONMENT OF THE CLASSROOM

The social environment of the classroom will always play a central role in determining how a computer is used by children in schools. It is our belief that if computers are to adequately support both the conventional and electronic literacy development of children, then computer-related activities must be woven into the fabric of daily classroom routines through planned activities in areas such as (1) teacher interactive demonstration, (2) thematic integration and innovation, (3) diverse collaboration, and (4) addressing special needs.

Teacher Interactive Demonstration

Our research suggests (Labbo, Phillips, & Murray, 1995/1996) that integration of technology can be achieved when teachers demonstrate the use of a classroom computer during whole-group and small-group lessons; however, the makeup of the demonstrations should not consist only of the teacher explaining or modeling the use of a computer. Rather, demonstrations should combine teacher modeling with opportunities for children to become involved. For example, teachers can solicit children's input during demonstrations of how to use the computer to maintain a calendar of events, to compose and print out notes to parents, to write and print out individual copies of the morning message and daily news, to make lists of things to do, and to create signs for classroom events. By socially negotiating the form, content, and context of the demonstrations, teachers can help children create a rich schema for employing technology in ways that quite naturally involve many literacy-related activities. Thus, the perspective we advocate implies much more than perfunctory uses of technology that place computers outside the mainstream of literacy activities in classrooms.

For example, from a sociocognitive perspective, we posit that children who observe and interact with teachers during whole- and small-group technology demonstrations will internalize relevant vocabulary, develop approaches to problem solving, and encounter action schemes—all enabling them to use the computer as a tool for thinking, learning, and communicating. As Papert (1980) suggests, children will use a computer

in ways that they see the adults in their lives make use of computers. Adult modeling of literacy activities is a major factor in children's acquisition of conventional literacy. It is no less so in the acquisition of electronic or digital literacy.

Other benefits of interactive demonstrations are evident when young children dictate personal news to add to the morning message, watch their words typed on the screen, and thereby have opportunities to become aware of graphophonemic aspects of print. Additionally, when each child receives an individual printout of the morning message and is invited to circle words, letters, or letter-sounds he/she recognizes, he/she has an opportunity to enrich or refine his/her conventional literacy knowledge.

Thematic Integration and Innovation

Creative teachers who put a classroom computer to its best use seem to consistently discover natural connections between curricular themes, learning objectives, and innovative uses of technology. The scenarios given at the onset of this chapter provide concrete instances of four guidelines that we have discovered to be instrumental in designing technology-related units such as the unit "Creatures That Fly in the Night Sky":

1. Collect, display, and demonstrate themed children's books and software related to the theme.
2. Design computer-based learning center activities connected to the theme.
3. Enhance sociodramatic play that connects the theme and computer-based activities.
4. Provide occasions for celebrating children's computer experiences and products.

First, collections of thematically related children's books and software are displayed, shared, and discussed. Just as books are selected to provide a variety of genres and perspectives on a theme, software can be selected to provide various types of literacy experiences related to the theme. Appropriate software for young children should be easy to open, easy to use, highly interactive, responsive to student choices, and ideally related to the other forms of classroom literacy experiences and skill instruction.

Some of the materials for Ms. Martin's unit consist of several fictional and informational books, two puppets with a puppet staging area, and three software programs that are displayed on a bookshelf close to the computer center. Her daily routine includes a shared reading of one of the books or a shared viewing of one of the software applications. On one day, she reads aloud the book *Stella Luna* (Cannon, 1993). Children discuss the story plot, the characters, and ways that the author of this fictional story helps us explore our feelings about bats.

On another day she conducts a shared viewing of the CD–ROM *My First Incredible Amazing Dictionary* (1995). Ms. Martin has a large monitor that allows her to display the computer output to all of her students. Much as a big book is recommended for sharing stories and concepts about print with a large group of children, a large monitor or some kind of projection equipment is recommended for shared viewing of software. Ms. Martin's shared viewing consists of the following steps:

- She begins by briefly introducing the title and general purpose of the software and then stating a specific purpose for interacting with the program. Her purpose is to find definitions and see illustrations related to unit topics. This activity helps her students understand that different software has different purposes and must be approached strategically depending on one's intentions. In other words, the decisions made before using the software will depend upon the intent. In this instance, the teacher shows how to access definitions through an alphabet index or a search and find function.
- Next, Ms. Martin reads or clicks on audio messages and animation that appear on the screen. While navigating through the program, the teacher briefly explains how selecting particular options helps to meet the previously stated goal of learning more about vocabulary related to the unit. While navigating through the program, children may be invited to take turns operating the software or offering opinions about the importance of various types of information included in the program. This activity allows children to develop strategies for making decisions while using the program on their own later.
- Last, after a shared viewing, Ms. Martin encourages the children to critically discuss the information, the presentation of the content, and the operation of the program itself. This activity helps students develop the ability to take a critical stance in using digital materials just as we hope they will in using conventional printed materials.

Second, center activities include computer-related activities aimed at accomplishing various literacy objectives. Ms. Martin's students all worked in the same computer center on the same day, yet they all selected different activities. By having a range of choices, the children learn how to select an activity that they find interesting and meaningful. They are also given occasions for making sense of topics across various classroom activities that include computer explorations. When children bring objects with them to the computer center, they may use the objects to inspire stories and illustrations, to focus them on the topic, and to help them

acquire information from different sources. As Schwartz (1985) has pointed out, three-dimensional objects such as a stuffed animal or a book may help young children connect to a similar two-dimensional object on the computer screen.

For example, after hearing Ms. Martin read the story of *Stella Luna* (Cannon, 1993), Ariel and Jasmine interact in what we have called a "screen and book read along" (Labbo & Ash, 1998) in the computer center. That is, children connect the audio, text, and animation of the screen with the print and illustration of the book by turning the virtual pages on the screen and the real pages in the book simultaneously. They point to the words in the book as they are read on the screen. Whether children choose to listen to an electronic book, echo read, or chorally read, our research (McKenna, 1998) suggests that the listening version of an electronic story can help young children develop a sense of story, extend their vocabulary, increase knowledge of words, and enrich concepts about print. During repeated readings of electronic books, when beginning readers click on unfamiliar words and either hear the word or receive a phonic minilesson, they can make substantial gains in sight word acquisition. However, this effect seems limited to those who can name letters and have a rudimentary awareness of sound–symbol correspondences.

Third, sociodramatic or dramatic play is related to the unit theme and to the use of technology. In Ms. Martin's room, the sociodramatic play center was transformed into a puppet theater equipped with puppets related to the characters in the books and software. Reenacting and often extending the story through dramatic puppet play gives children additional occasions for trying out characterizations, reinforcing story structure, and reliving or innovating on story plots.

When sociodramatic play centers are enriched with literacy props, including a computer or even a cardboard model of a computer, children gain insights into the role of technology and literacy in various cultural and workplace settings (see Neuman & Roskos, 1992; Labbo & Ash, 1998). For example, if a unit theme focuses on various ways to travel, the sociodramatic play center may be transformed into an imaginary travel agency. Children may make tickets, timetables, maps, travel posters, destination booklets, and passports to use in their play scenarios. The office may be set up with a cardboard model of a computer, available at local office supply stores, a play telephone, notepads, nameplates on desks, credit card facsimiles, and brochures. An interview with a travel agent or a field trip to a travel agency can help children understand how the office works, the role of literacy in the work that takes place there, what types of conversational discourse are appropriate in that setting, and how computers are an integral part of the environment. By playing in the center, children have opportunities to enrich their schema about workplace forms and functions of literacy.

Fourth, children's computer experiences and work are celebrated. When children learn how to use a computer to accomplish communicative tasks, teachers can invite them to demonstrate and explain their newfound knowledge to their classmates. Collections of students' theme-related work may be bound into a class book, exhibited as artwork, or displayed in a computer presentation such as an electronic slide show. As is the case with printed materials, celebrating accomplishments and finished products involving digital materials enhances motivation and engagement.

For example, in our work with students in the upper elementary grades we found that involving teachers and students in creating multimedia book reviews on the computer had far greater benefits for reading and writing than did conventional book reports. Students were much more engaged in creating the multimedia book reviews, and we found that their use of technology to respond to their reading involved them in a much richer socially interactive process. We found that these benefits were derived partly from the fact that, unlike conventional book reports, the multimedia book reviews were stored in a searchable database that was easily accessible to other students looking for books to read and to parents who visited the school at various times (including a school technology fair). Inevitably too, students' interactions about the books they were reading took place incidentally in the context of celebrating their accomplishments in mastering the technology. For example, when one student eagerly explained to another student, who was an equally avid listener, how he had added sound effects to his book review, the other student incidentally discovered an interest in the book that was the subject of the review. This example also illustrates how celebrating accomplishments in one medium can enhance involvement in another medium.

Our work (Reinking & Watkins, 1996) suggests that when teachers make children's multimedia book reports accessible through a networked framework that is authored and presented on hypertext, students electronically share book titles, exchange information about authors, and consider various responses to books. Additionally, a child can make intertextual links, or electronic connective paths, between information in their own book report and related information in the reports of their classmates. Having easy access and tools to make such links gives students a capability to manage the exchange of information that is unique to an electronic environment. Now teachers are increasingly aware that computers are becoming a central part of literacy instruction and learning in the classroom.

DIVERSE OPPORTUNITIES FOR COLLABORATION

Children who collaborate while working on the computer have opportunities to acquire conventional and electronic literacy knowledge. Traditional writing processes employing paper-and-pencil tools are enhanced by the electronic malleable screen, the keyboard, and the availability of tools for cutting and pasting elements of texts. Additionally, Internet and e-mail interactions can foster unique forms for students' socially constructed learning experiences.

For example, a process writing approach to composition, involving activities such as Writing Workshop may be enhanced by computer-based collaborations. When children brainstorm, write drafts, revise, edit, and publish with a word processing program, they can focus more on managing their ideas and less on tedious mechanical aspects of writing (Jones, 1994). When writing is supported by a word processing program, the computer may be viewed as an interactive partner in the writing process. Such a view is especially warranted when a child's communicative intentions involves multimedia, such as audio and video. Creating high-quality final drafts is also facilitated by desktop publishing capabilities such as formatting text, incorporating graphics, and selecting typefaces. Wild and Braid (1996) note that collaborative or cooperative computer-related word processing experiences foster children's cognitively oriented talk that is focused on the task of writing.

We believe that it is crucial for teachers to provide enough time for children to compose on the computer and not just type a handwritten draft in order to print out their work. To reap the benefits of technology, and indeed to prepare children to use the tools of contemporary writing, word processing must be integrated into all phases of the writing process. Students may keep an electronic file of their work, such as a reflective journal, topic ideas, responses to books, works in early draft progress, works to be edited or spell checked, or works to be read and responded to by a peer. In these instances, the computer is used as an organizer, a manager, and an electronic writing folder similar to a conventional portfolio. However, unlike a conventional portfolio, an electronic one reinforces the idea that electronic writing is never a final product. Each electronic file awaits future modification.

Paired keyboarding occurs when one child who has knowledge about computer operations and the Internet works together with another child who is less knowledgeable about accessing information from the Internet. Peters (1996) suggests that such interactions extend the less able partner's zone of proximal development, enabling the child to internalize strategies for successful explorations. Other effective collaborations can emerge from electronic pen pals. Garner and Gillingham (1998) explain how students use e-mail to communicate effectively with students in different geographic regions. Beach and Lundell (1998) report that shy students become more interactive and even develop unique on-line personalities when they exchange messages through electronic communication systems.

SPECIAL POPULATIONS

Technology can support the literacy learning of special populations of learners who may be mainstreamed into the classroom. Students in all grade levels who struggle with reading and writing may benefit from particular computer applications. Nonfluent readers, reluctant readers, or children who study English as a second language (ESL readers) may also benefit from features of software. We believe that teachers should approach the use of technology with special populations by following the guidelines we have outlined, namely, through teacher interactive demonstrations, thematic integration and innovation of software and books, and diverse collaboration.

Supporting Struggling Readers and Writers with Computers

Many children who struggle with learning to read and write in elementary schools can often benefit from the electronic text formats. Traditional instructional and tutorial approaches for readers experiencing difficulty learning to read have been based on a determination of a child's strengths and weaknesses. From this traditional perspective, a teacher or a tutor decides how to support the struggling reader by presenting materials, introducing skills, and managing reading practice at a slower pace than that of the regular classroom (Walmsley & Allington, 1995). Once struggling readers have become familiar with the unique features of hypertexts, they may be allowed to self-select the type of support they believe is the most beneficial, thereby allowing them to maintain a pace similar to that of the regular classroom.

How readers use supported text will vary with their developmental level. Emergent readers, for example, will gain more from accessing the full listening version of a text than from more advanced resources. Children who are functioning within the decoding stage, however, can be expected to rely heavily on digitized pronunciations. Those who are approaching fluency will have greater recourse to glossary entries, prose simplifications, digitized video clips, and the like as they endeavor to acquire content from expository text. At this stage, their comprehension will also benefit from accessing linked resources, such as graphic orga-

nizers, databases, or electronic encyclopedias. Since the efficacy of these resources is based on aligning software use with a child's stage of reading development, it is important that assessment be aimed at precisely determining that stage so that a teacher is able to guide the child toward the most appropriate use of such resources (McKenna, Reinking, Labbo, & Kieffer, in press).

A future abundance of supported text will bring both drawbacks and advantages for the struggling reader. Surely one of the challenges of electronic literacy is the need to develop the ability to strategically navigate through hypertext environments in order to achieve specific purposes. Even when the hypertextual elements are limited to a few helpful resources, the effect of so many choices can appear labyrinthine to a struggling reader. On the positive side, students will be able to read text independently that would have frustrated them without the built-in support of what McKenna (1998) has called "electronic scaffolds." Indeed, the very notion of the instructional reading level will have to be revised in electronic environments since many struggling readers will be able to read at or near their listening levels (McKenna, Reinking, & Labbo, 1997).

Supporting Nonfluent, Reluctant, or ESL Readers and Writers with Computers

Children who are nonfluent or reluctant readers may benefit from repeated or echo readings of text that is digitally read aloud. While reading to learn new information, a struggling reader may find it useful to compose and record summaries of passages on an electronic clipboard. Burns (1996) notes that multimedia technology can be used to facilitate the English language acquisition of non-native speakers. Multimedia resources accommodate the needs of ESL students as they progress in second language proficiency and gain specific content area knowledge. Many electronic, interactive books have the option of listening to the story in either Spanish or Japanese. More research about the effectiveness of such programs on children's acquisition of a second language and their understanding of specific reading passage content is needed.

Finally, speech synthesizer software offers some promising directions for supporting the spelling development of young, ESL, or nonfluent writers. Shilling (1997) introduced the use of a basic word processing program and an external speech synthesis unit that gave the children studied a choice of listening to a word they had attempted to spell on the screen, listening to the entire text that they had typed on the screen, or not using speech synthesis at all. Findings suggest that before children consistently benefit from synthesizer software they need to have acquired

some basic concepts about print, phonemic awareness, and a notion of the alphabetic principle. As the capabilities of speech synthesizer software improves, continued research in this area is warranted.

A FINAL WORD

We hope it is clear in this chapter that digital forms of reading and writing not only can be but must be integrated into the mainstream of literacy instruction for children in the elementary school. Establishing a program of best practices in literacy instruction today means acknowledging that literacy is no longer a monolithic concept defined by print, pages, and books. Attention to conventional uses of written language centered in a world of print must be balanced by attention to how digital technologies are increasingly moving toward the center of what it means to be literate. Teachers, even those who teach young children at the earliest stages of literacy development, must begin to initiate their students into the use of digital forms of expression with a vigor equal to that they have dedicated to more traditional printed forms.

We would be the first to admit that this is no easy task. To integrate technology into their teaching, teachers must confront many challenges on multiple levels. Not the least of the challenges many teachers face is coming to terms with their own predisposition to favor printed materials, sometimes accompanied by a devaluation of digital reading and writing as inferior. It is hard for some teachers to consider, let alone accept, that emerging forms of electronic reading and writing may be as informative, pedagogically useful, and aesthetically pleasing as more familiar printed forms. To consider that electronic forms of text may in some instances even be superior is undoubtedly more difficult.

A reluctance to embrace technology is often sustained by insecurities in using computer technology. It is not trivial to note that today for the first time in the modern era teachers have an obligation to prepare children to become literate in ways that the teachers themselves might not be fully literate. This situation is created by the juggernaut of change that has occurred in the lifetimes of many teachers today who are witnessing the digital revolution but who themselves have to some degree been left in its wake. It is hard enough to think about preparing children for the fuzzy future of literacy in a posttypographic world. It is even harder to prepare children for a world in which our print-based literacy skills are less central, let alone for a world that may negate some of our most cherished assumptions about literacy.

Beyond these conceptual issues are a host of practical obstacles that teachers must often overcome. While the base of computer hardware in

schools is generally seen as adequate, many schools do not have the physical or administrative infrastructure needed to use their computers effectively (Morra, 1995). For example, computers are of little use if there is not adequate wiring in places where teachers and students need to use them. Neither are they useful if there is no opportunity for teachers to learn how to use them and to become familiar with software and how it might be integrated into instruction. Neither are they useful when there are no established instructional niches in the curriculum and school day for computer use, especially in the language arts, at least beyond word processing. Moreover, there are logistical problems involved in bringing students and new technologies together in time and space. This challenge is often faced by teachers who have only one or two computers in their classrooms or who can only have access to a computer lab for an hour or two a week.

So, how are teachers to cope in achieving balance between a focus on conventional literacy and electronic literacy? We have found some commonalities among teachers who have successfully achieved this balance, especially among those who do not gravitate naturally to technology. Most teachers have been realistic about the obstacles they face in using technology and realistic about expectations given these obstacles. Often they have found a single computer-based activity or application that connects powerfully with their own teaching and with their personal conceptions of literacy. They may have found it at a conference, in a university course, or through a colleague; but it is something they find it hard to imagine teaching without, once they have discovered it. It may be a simple program addressing in some new way a problematic reading skill, or it may be a more open-ended and sophisticated application involving the internet. For many teachers finding such an application stimulates them to confront the challenges of using technology in their teaching. For them, it serves as a gateway to seeking more balance between conventional and digital literacies.

We recommend that teachers who wish to integrate technology into their literacy teaching consider several ideal criteria aimed at transcending perfunctory uses of computers. If technology is used to advance the goals of conventional print-based literacy, software applications should, at a minimum, be consistent with what the teacher knows and believes to be true about reading instruction (Miller & Burnett, 1987). Ideally use should be made of the unique capabilities of the computer to go beyond conventional materials, addressing some problematic area of literacy that would benefit from a new approach.

Different criteria are relevant if technology is used more to initiate students and teachers into the world of digital literacy. First, like other literacy activities, technology-related activities should ideally involve authentic and personally meaningful communication. Electronic worksheets

are in the long run no more meaningful and useful to students' development than are printed ones. Using the computer to enable a kindergarten child to read more texts independently is more worthwhile, as is enabling third-grade children to use e-mail to correspond with other children and adults around the country. Another ideal criterion is that the activity will allow teachers and students to compare and contrast electronic and digital forms of reading and writing. For example, how is an electronic storybook different from a printed one? What are the advantages and limitations of a multimedia encyclopedia over a printed one? How is e-mail similar to or different from sending a letter mailed at the post office? Finally, computer-based activities that increase literacy in the digital domain should allow students to develop functional strategies for reading and writing electronic texts. For example, when might it be appropriate to seek out the pronunciation or definition of a word while reading? How are key words used efficiently to locate information in a computer database?

As Bruce and Hogan (1998) point out, technologies that are truly integrated into daily life are invisible. Fully integrated technologies blend into the environment by virtue of their repeated and natural use. No one views stairs leading from one floor to another as a complicated technology—except someone who is confined to a wheelchair. Integrating computer-based activities into literacy instruction in schools has a long way to go before new technologies are completely unremarkable. Nonetheless, teachers who choose *not* to wait until digital reading and writing are so widely used as to be scarcely noticed are laying the groundwork for the day when computer technology will be as fundamental to literacy as is print technology today.

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