SCHOLASTIC

LITERACY RESEARCH PAPER

VOLUME 11

# Expanding the Literacy Toolbox

## Why we must broaden our definition of literacy and incorporate new media in the classroom

*David Rose and Anne Meyer*

For over a century we have been striving to reach the goal of universal literacy. Although more children can read and write than ever before, there is growing concern that we are no longer making progress. Worse, there is widespread alarm that we are losing ground. A recent survey measuring international literacy shows that although the United States can claim a large number of adults (19 percent) who scored at highest levels of literacy, 24 percent scored at the lowest levels, just above Poland, the industrialized nation that ranked the lowest (Organization for Economic Co-operation and Development; l995).

We have made progress. In the l920s, only one in four Americans went to college. In the 1950s, it was one in two. In the 1990s, it is three of four. The paradox of such progress is that it isn't good enough. Americans are entering a changed and competitive workforce that requires new sets of skills to succeed. Our increasingly information-based culture demands correspondingly increased levels of knowledge and skill. More centrally, the definition of what constitutes literacy in our culture is changing dramatically. The kind of literacy now required for satisfactory performance in business, industry, academia, and government is not the kind of literacy toward which schools have been striving.

We cannot achieve the goal of universal literacy by continuing to rely on current approaches and technologies. This paper traces the development of communications technologies and their relationship to pedagogy over the centuries. It also makes an urgent case for applying new technologies to today's

classrooms. When we do, we will not only make strides in achieving the goal of universal literacy, we make it possible for all learners, no matter what their background, experience, or special circumstance, to learn to read and write with power and purpose, early in their lives as students.

Literacy for the future means *literacy in multiple technologies.*

The historical perspective in this paper shows why *Scholastic Literacy Place,* with its *WiggleWorks Plus* and *Smart Books,* is a leader in the use of new technologies to support all learners.

### Oral language was once the primary means of communicating.

Several hundred years ago, when oral language was the primary means of transmitting knowledge and communicating, no technology was required to be "literate." Effective speaking was the critical communication skill and a key focus of instruction (see Figure 1).

Consider the power of a well-constructed oral argument or narrative. The speaker can convey ideas dynamically, with appropriate affect and emphasis, while analyzing and responding to the reactions of the audience. The audience can participate actively by asking questions or challenging points, with the result that highly effective communication can take place. The live, interactive context leads to modifications of the content, which in turn is dynamic.

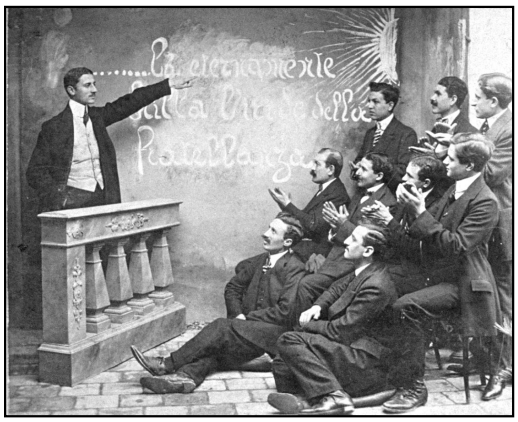

Figure 1: Oral presentation permits direct interaction. The result is that effective communication can take place.

### Oral language isn't permanent; written language is.

The content of oral language is dynamic but not permanent. The advent of written language some 5,000 years ago enabled people to render language and thought into a more permanent medium — irrevocably changing the generation and transmission of knowledge. Written language, particularly after the development of the printing press, provided a lasting format and made possible the distribution of ideas on a large scale. Wide availability of printed information made it possible for communities of scholars to grow apart from each other — scholars who would then share their learning with others — leading to the development of the concept of universal literacy.

Figure 2: Written language brought new technologies to be mastered and new skills to be learned.

### Writing instruments were the first literacy technologies.

Written language brought the first technologies of literacy — writing implements and materials — and new skills to be learned — encoding and decoding (see Figure 2). Mastery of complex tools and skills became necessary in order to communicate effectively. Wide availability of written

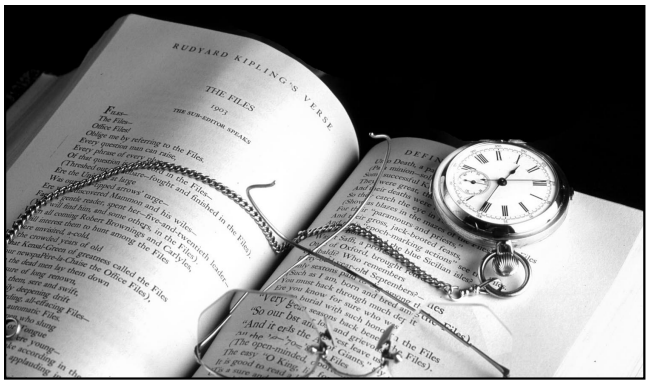


Figure 3: Pedagogy was reshaped around tools and skills of written language.

content came at the price of decreased ease of access. Transmission to writing also diminished dynamism. Intonation, affect, and emphasis are more difficult to convey through writing than in a face-to-face exchange.

### Written language changed the nature of pedagogy.

Pedagogy was reshaped around the tools and skills of written language (see Figure 3). Learning to use books and writing implements, to encode and decode language, became principal enterprises of school. The codification of knowledge in books also tended to elevate the significance of that knowledge. The teacher-student relationship was structured around the transmission of a body of information. Changes in that information came at relatively long intervals, in part because of the complexity and expense of issuing new editions in print.

### Recording technologies made possible widespread communication with minimal diminution of impact. However they too are fixed media.

After four centuries during which literacy was defined by the technology of print, new technologies for communication began to emerge. The development of recording technologies — still photography, sound recording, film, and video — made it possible to capture, preserve, and distribute communications with minimal diminution of impact. Broadcasting began to supplant print publishing as the primary vehicle for mass communication. These technologies made their way into classrooms, providing alternative media for conveying knowledge without requiring decoding. It seemed that almost all of the advantages of oral language had been recovered.

While these recording technologies broaden the set of tools and communications options in today's classrooms, they, like written language, are fixed media. Films, slides, audiocassettes, and videocassettes are used primarily for presentation to students, affording limited opportunity for students to act on or interact with the content presented. In almost no cases are source materials edited or changed by teachers or students. Children rarely make records, films, or video. To borrow a phrase from the computer revolution, these new media are "read-only" in most classrooms, used for presentation, not exchange. Even with these expanded tools, their fixed nature makes it difficult for learners to be truly active or expressive. Though these new media entered classrooms, they didn't bring about significant changes in the nature of teaching and learning.

### It's time to tap the pedagogical potential of the new malleable, or editable, media.

New technologies of the last two decades are altering the way we communicate, express ourselves, and learn. Computers, telecommunications systems, satellites, optical disks, and others store and transmit information digitally rather than on film, paper, or tape.

The new media created by these technologies are radically different from previous communications media in two key ways:

- Media recorded and stored digitally remain malleable, or editable. They are not fixed media; you can alter them. For example, a photo taken with film is hard to change. A photo taken with a digital camera is infinitely changeable.
- A single tool — the computer — can be used to record, store, and manipulate a variety of representations for information (text, sound, graphics, audio, video, animation, etc.).

Let us explore these key differences.

### The malleability of new media presents unparalleled opportunities for interactivity.

The malleability of information stored electronically allows easy editing of sounds, images, text, or video. With desktop computers, teachers and students can compose and edit with a variety of media. In the collaborating research schools of the Center for Applied Special Technology (CAST), elementary students frequently work with multimedia. One fifth grader's multimedia report on music included sound clips, images, and video clips, all used much as a slide show might be to support an oral report. Some screens contained only sound clips to illustrate a musical point, others combined digitized photographs. Digitized clips from videos of singing groups were also included.

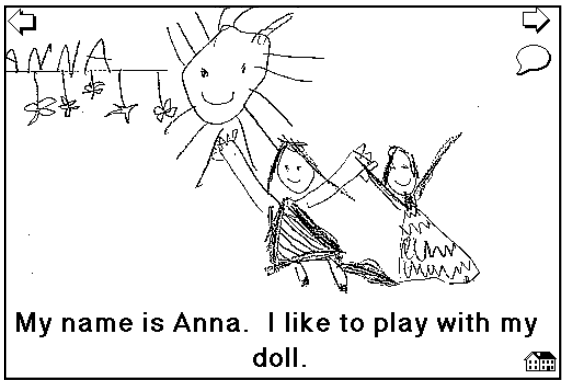


Figure 4: A screen from a multimedia kindergarten composition in which each student drew a picture, scanned the picture into the story, and recorded a personal message that is played back by clicking on the speech balloon.

Figure 4 shows a kindergarten group project in which each student drew a picture, scanned the picture into the story, and recorded a personal message that is played back by clicking on the speech balloon. Teachers assisted students in entering text to match the spoken messages.

Figure 5: The author team works collaboratively to finish this paper.

Figure 6: Thanks to today's new malleable media, the half of author team who is quicker with the mouse gets rid of a coauthor after an editorial dispute!

### The malleability of media raises issues that must be addressed and questions that must be discussed with students.

Figures 5 and 6 offer a whimsical example of a serious discussion being held by ethical, legal, technology, and communications scholars. Figure 5 is an image of the authors in the early stages of a collaborative effort. Figure 6 represents changes made in the image by one author later in the project, after a particularly contentious editorial dispute.

When *WiggleWorks: The Scholastic Beginning Literacy System* (see below), and *WiggleWorks Plus* were created, we deliberately worked with authors and illustrators to ensure that students would be able to use the text and illustrations in the *WiggleWorks* books to create new work of their own. But many copyrighted materials do not provide for such uses and therefore, although often malleable, cannot be changed or disseminated without the ex-

press consent of the copyright holder unless specific classroom uses are provided for in the copyright information. The power of malleable media raises important legal questions that teachers must become aware of. While publishers are beginning to provide malleable usage in classroom materials, it is important to check the copyrights of the new media, just as it is in the "old media" to determine what constitutes fair use in classrooms.

Other questions concern communications ethics. Figures 5 and 6 provide a lighthearted look at what could happen when the two authors of this paper disagree. More serious ethical issues are raised when a magazine "morphs" a photo of its cover subject; when a publication melds two photos so that it appears the President appears to be holding a conversation with a person at a certain time and place when in fact the conversation didn't occur; when TV news reports use editing technologies to create news scenes that are actually reenactments or show their reporters standing in the cold in front of the White House when in fact they actually are inside a cozy studio. These questions, at developmentally appropriate points, are all part of necessary discussions teachers must have with students about the ethical issues the new technologies raise. This is part of a new civic literacy we must help students develop as they expand their communications skills.

A computer's capacity for combining media offers students myriad channels of information on a subject through a single source.

The power of computers to combine media has led to the proliferation of information and education products drawing on that power. Examples include multimedia encyclopedias; books on disk incorporating video, audio, and animation segments to elaborate on text content; databases storing information in varied media; and countless other applications. Figures 7 and 8 are screens from computer programs that illustrate the use of combined media.

Figure 7 shows a screen from a music CD with companion software. The software includes a glossary that accesses the CD to illustrate musical terms. The screen shown in Figure 7 illustrates Beethoven's use of a theme and descant. Clicking the "Play Theme" and "Play Descant" buttons plays each part separately using the

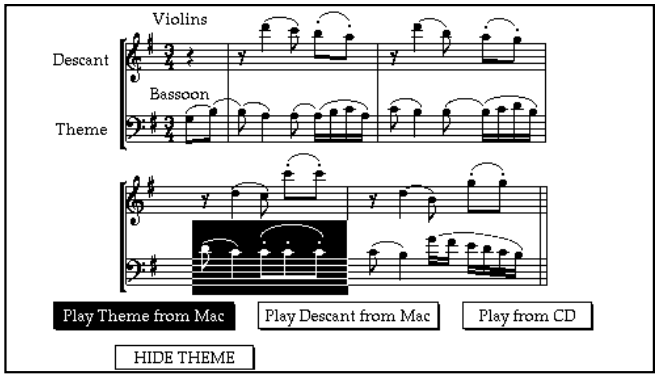


Figure 7: A screen from the Voyager CD Companion: Ludwig Van Beethoven Symphony No. 9 illustrates the composer's use of a theme and descant.

computer's sound while highlighting the appropriate parts of the score. Clicking the "Play from CD" button plays the combined theme and descant from the CD itself. Combined media enhance the power of information display and increase the effectiveness of instructional tools.

The plasticity of the new media is the key to their profound difference from all previous media and to their extreme centrality in reshaping literacy, literacy curriculum, and our understanding of human capacity.

The new literacy tools demand that we rethink literacy and help all students become media literate.

These new tools are redefining the way we communicate — in our homes, in the workplace, and in our local and larger

communities. Literacy in our culture must now include not only the tools of print but also the tools of the new media.

Patricia Aufderheide, Associate Professor of Communication, American University, writes about the necessity of becoming media literate in a report of The National Leadership Conference on Media Literacy: "Media literacy, the movement to expand notions of literacy to include the powerful post-print media that dominate our informational landscape, helps people understand, produce, and negotiate meanings in a culture made up of powerful images, words, and sounds….

Literacy in our culture *must now include not only the tools of print but also the tools of the new media.*

A media-literate person — and everyone should have the opportunity to become one — can decode, evaluate, analyze, and produce both print and electronic media. The fundamental objective of media literacy is critical autonomy in relationship to all media. Emphases in media literacy training vary widely, including informed citizenship, aesthetic appreciation and expression, social advocacy, self-esteem, and consumer competence" (Aufderheide, l993).

The changes are evident in every sector of society. *What Work Requires of Schools,* by the Secretary of Labor's Commission on Acquiring Necessary Skills, is emphatic about changes occurring throughout the workplace. "[The computer] has reconfigured the world of work as have perhaps no other inventions since electricity or the assembly line. It has created not only a new industry; it has redefined the way thousands of different kinds of work are now carried out" (Brock, W. E., et al. l991).

Literacy in the workplace is more interactive and collaborative, and requires the use of multiple technologies for effective communication. The authors of the SCANS report implore educators to prepare children for the new literacy: "If you do not, you will be failing your students and your community as they try to adjust to the next century" (SCANS, 1991).

### These new media provide new tools to create curricula and instruction to support every learner.

The new media that are changing the world of work also offer unprecedented opportunities to support children in the process of becoming literate. The same qualities that differentiate these media from print — malleability and multiple representations — can be used to build curricula and design instruction to support active, collaborative learning for children whose needs and styles vary widely.

### Malleability supports instruction by allowing students to act on text and observe the effects.

The plasticity of digital media is very significant for many instructional settings and for students of all levels. For example, digital text is far more flexible than text committed to paper. This flexibility enables students to learn about language and ideas by acting on text — changing and experimenting with it — and observing the effects. Suppose a first-grade class is reading and working with rhyme through traditional nursery rhymes. Although students can read and enjoy the poems in printed form, the fixed text does not invite active engagement. Consider the opportunity afforded by presenting a text electronically, projected on a large screen in front of the group (Text 1). The group finds the rhyming words, and the teacher or a student at the keyboard highlights them and changes the text color (Text 2).

Next the teacher deletes the words and replaces them with a new rhyme suggested by the group (Text 3).

Text 1

There was an old woman
Lived under a hill
And if she's not gone
She's living there still.

Text 2

There was an old woman
Lived under a hill
And if she's not gone
She's living there still.

Text 3

There was an old woman
Lived under a bough
And if she's not gone
She's living there now.

The teacher can then make multiple copies of the original and elicit further variations on the poem, supporting students as they change many other words. Through this collaborative activity children can experiment with the rhythm, rhyme, and meaning of language within a carefully structured poetic framework:

There was an old woman
Lived under the ground
When visitors came
She could never be found.

There was an old woman
Lived in an airplane
When she'd seen the world
She settled in Spain.

Working with electronic text and either a large monitor or a projection plate, generating variations is a highly interactive, collaborative process. As students call out their ideas, the teacher records them "live," enabling students to observe the process of writing, editing, and revising and to read the new versions as they evolve. Individual students can read variations aloud, and the group can continue to revise them or create new variations.

Students who have difficulty with handwriting or spelling can participate in the process orally and feel proud of their contributions. The variations can be printed, each on a page, illustrated by individual students, and published in a class book. The malleability of electronic text enables teachers to model processes and to engage students in the active manipulation of language.

This same malleability supports learning of more sophisticated concepts for older students. Consider a fifth-grade class working on the concept of author's point of view. The class is working with a report on a basketball game, written by a student for the school newspaper:

*The key point in the game came in the fourth quarter. The Astros had battled*

Scholastic Literacy Place
Philosophical Foundations

*1. Literacy is developed within the personal, social, and intellectual contexts of the learner.*
*2. A literacy program should provide developmental continuity.*
3. The successful learner is motivated, strategic, knowledgeable, and interactive.
*4. Children learn best when they have real purposes and can make connections to real life.*
*5. Effective learning is a combination of student exploration and teacher and mentor modeling.*
*6. Assessment is an ongoing and multidimensional process that is an integral part of instruction.*
*7. Making reading and writing connections across multiple sources and curricula facilitates meaning.*
8. Literacy for the future means literacy in multiple technologies.
*9. Education must respond to society's diverse population and must serve all children.*
*10. Interactions among students, teachers, parents, and community form the network that supports learning.*

*back valiantly to tie the game at 55-55 with three minutes to play. Bill Bailey, the Bullets' most bruising player, lumbered in from the bench, looking for a way to steal the game. The hostile home-court fans screamed ferociously. On the in-bounds play, he got his chance. A high lob pass from Robbins to Bailey was too short. Astros forward Chuck was perfectly placed to intercept when Bailey crashed through him, grabbing the ball and knocking him flat to the ground. No call from the referee! Bailey turned and, with no defender left in sight, slammed the ball through the net. Bullets lead. The ball game's over.*

Beginning with the original text, the teacher elicits hypotheses about which words and phrases convey the author's viewpoint — in this case, a bias toward the Astros. Were the article in print form, students could highlight or underline relevant passages; but with the text projected onto a large screen, the group can work dynamically.

As students suggest words or phrases that seem to reflect the author's point of view, a student or the teacher at the keyboard can change the color of the text in those words and phrases. The group can evaluate the selections as they happen, discussing which ones seem critical to the creation of the viewpoint:

*The key point in the game came in the fourth quarter. The Astros had battled back valiantly to tie the game at 55-55 with three minutes to play. Bill Bailey, the Bullets' most bruising player, lumbered in from the bench, looking for a way to steal the game. The hostile home-court fans screamed ferociously. On the in-bounds play, he got his chance. A high lob pass from Robbins to Bailey was too short. Astros forward Chuck was perfectly placed to intercept when Bailey crashed through him, grabbing the ball and knocking him flat to the ground. No call from the referee! Bailey turned and, with no defender left in sight, slammed the ball through the net. Bullets lead. The ball game's over.*

Finally, the group can change the viewpoint of the piece by substituting new words and phrases:

*The key point in the game came in the fourth quarter. The Astros had gotten away with some sneaky moves to tie the game at 55-55 with three minutes to play. Bill Bailey, the Bullets' most courageous player, rose from the bench, looking for a way to save the game. The hopeful home-court fans cheered mightily, urging him on. On the in-bounds play, he got his chance. A high lob pass from Robbins to Bailey was too short. Astros bruising forward Chuck muscled in to steal the ball when Bailey jumped high over him, grasped the ball, and landed gracefully as Chuck crashed into him and then to the floor. No call from the referee! Bailey turned and, with no defender left in sight, dunked the ball through the net. Bullets lead. The ball game's over.*

These examples illustrate curricular applications of flexible electronic text. With the new media, other representations of ideas, including sound, image, animation, and video, can support engagement and varied learning needs.

### Multiple representations make it possible for every learner to have access to the same information.

The capacity of new media for multiple representations carries many pedagogical advantages. Concepts are presented in different media within one electronic document. Software includes tools that support transformation of information from one medium to another.

For example, through the technology of synthetic speech, computers can "read aloud" whatever text is typed into the

computer, transforming text into speech. Synthetic speech is available in some word processors, notably those designed for young children. Dr. Peet's Talk Writer from Hartley Courseware is one example. Synthetic speech is also included in some early literacy software such as *WiggleWorks: The Scholastic Beginning Literacy System* (see below).

Speech feedback from their own text supports students in learning about the relationship between spoken and written language. At the level of single words, children actively explore phonics and sound/symbol correspondences by typing letter combinations or words onto the screen and then asking the computer to read them aloud. This capacity enables students to explore what happens when the same letters are placed in different contexts (at/ate; rough/through). They also discover the nature of predictable patterns as they simply begin to enjoy playing with sounds and letters.

At the level of sentences, students use speech feedback to self-monitor their work. As they write and edit, or try new phrases, they test the sense of the passage by having the computer read the selection aloud. Students working independently or students with reading/writing difficulties particularly benefit from speech feedback, as it enables them to hear omissions or spelling errors that they might be unable to notice from the text alone.

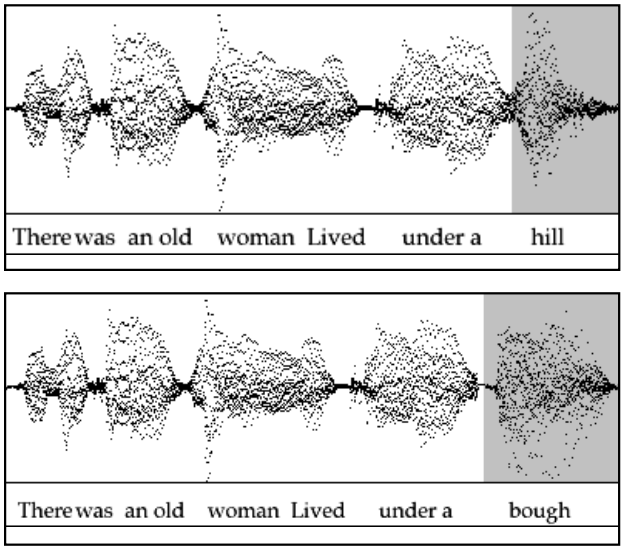


Figure 8: Sound wave with corresponding text. The word hill is highlighted in the original line; the word bough replaces it in the revised version.

Another representation supported by digital media is the direct recording of speech and sound.

For students who have difficulty with text, the composition process is supported by recording words and sentences digitally, playing them back, and editing them with a sound-editing program. Sound-editing software displays the wave form of the sentence, which can also be played back, edited, and revised. In the example of the nursery rhyme above, students could record the original poem, then revise the sound wave to create new versions. Figure 8 shows the recorded sound wave and corresponding words from first two lines of the poem, both the original and revised versions.

By highlighting the segment of the wave representing the words they wish to edit, students can delete words and play the line back without them, or add new words at appropriate places and play the line back in its revised form. Or they can rerecord the entire line with a change of inflection and expression to support the new version.

This approach supports students in the exploration of language, enabling them to vary the intonation, rhythm, and content of compositions. The option of working with digitized speech benefits students who have difficulty with spelling or with production of text. They often find it helpful to compose and revise first using digital sound, then generate text when the composition is refined. Because they can be incorporated into multimedia compositions and projects as part of a dramatic

production, digitized speech and sound also support the development of alternative formats for students to demonstrate their work and build portfolios.

The examples above don't require state-of-the-art technologies. Instead they use common applications such as word processing and sound editing software. Developers of curriculum are only beginning to utilize the great flexibility and power of new media.

### New media and a new definition of literacy cause us to rethink student capacities.

Changes brought about by new media reach beyond literacy and curriculum, affecting our understanding of the very nature of individual differences. In particular, as educators, we are reconsidering our views about "ability" and "disability" in children.

*Changes brought about by new media reach beyond literacy and curriculum, affecting our understanding of the very nature of individual differences. In particular, as educators, we are reconsidering our views about "ability" and "disability" in children.*

The nearly total focus on the technology of print as the basis for literacy has ensured that some children are unsuccessful in spite of great potential. For children who are blind, or who have motor disabilities that prohibit the use of tools like pencils and books, the barriers in traditional tools are completely exclusionary. For the child with dyslexia, the exclusive focus on print literacy is likely to lead to his or her identification as impaired.

Now that the learning toolbox is expanded, it seems obvious that the options for literacy learning should be as varied as are the children themselves. This is even more essential for children at the extremes, those we call disabled. When we limit a child with dyslexia to expression through print, we practically ensure that failure will dominate over success. When we provide a full palette of communication tools, such as those supporting graphics and sound as well as text, we provide opportunity for an education in which success and challenge are balanced.

### When only one medium is chosen for literacy, all individuals are judged in terms of their success in that medium.

When multiple media are a part of literacy, individuals have an opportunity to choose the most appropriate vehicles for themselves and for the effectiveness of a particular communication. Skills in areas that are not text or print related can be developed, esteemed, and appreciated; students can learn to use the tools that will be a part of their working lives as adults.

### New media help us accommodate individual differences.

Besides offering a more varied toolbox, there is a crucial capacity of new media: the ability to accommodate individual differences. Smart software design can help teachers and students customize the way content is displayed and the way students access tools and compose their work. The actual interface can be shaped and changed for different students to accommodate individual needs. To increase accessibility, text can be transformed to speech or vice versa; still and moving images can be described in speech; and sign language can be displayed as video. The capacity for transformation makes it possible to optimize presentations depending on the nature of the information and the access preferences of the user.

*WiggleWorks: The Scholastic Beginning Literacy System*, and *WiggleWorks Plus*, part of *Scholastic Literacy Place*, are early literacy curricula that take advantage of the

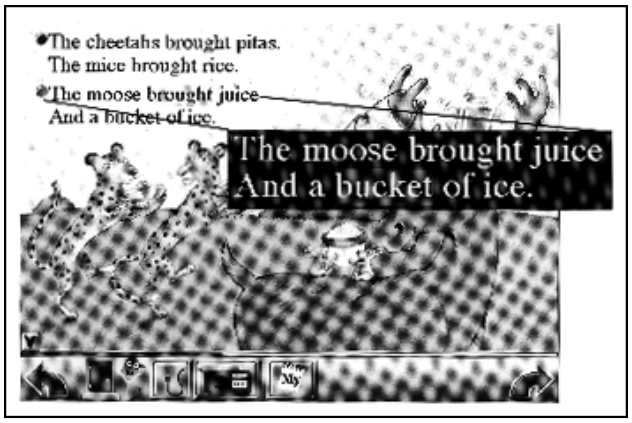


Figure 9: In *WiggleWorks* and Literacy Place's *WiggleWorks Plus*, teachers and students can select the text, background, and highlight color or choose large text for the display of stories.

flexibility of new media to accommodate individual differences and to support alternative styles of learning. Stories for early reading and response are provided both in print and on CD-ROM. The electronic version includes a rich set of interactive learning activities. Access to the content in *WiggleWorks* and *WiggleWorks Plus* is supported by customizable options for information display and for program control. These options support learners with a variety of abilities, disabilities, learning styles, and preferences. Among the options are customizable settings for:

- Visual display, including color options for text, background, and highlight, and an option for large text. These options support children with visual impairments.
- Physical access, including a scanning option to support control of the program via a single switch rather than a keyboard or mouse. Choices on the screen highlight sequentially and can be selected by clicking when the desired choice is highlighted. For children with motor disorders, these options circumvent the keyboard and enable participation in the program.
- Reading and writing supports, including options for pacing highlighting and reading text aloud, for highlighting by word or by sentence with or without speech, and a personal notepad for collecting words for use in later writing or word analysis work. These options support readers of different abilities, including those with attention difficulties or learning disabilities (see Figure 9).

## As the technologies of communication and information change, the requirements for literacy also change.

For those who grew up in a world dominated by the technologies of print, mastery of the technologies of writing and reading text constituted literacy. The addition of video- and audio-recording tools did not impact the nature of literacy in a major way because these tools were used primarily to deliver information. The primary shift brought about by computers is that audio, video, and image-based materials are no longer primarily used for delivery of information — they are now viable media for communication and exchange. With digital tools, teachers and students have the capacity to compose and construct communications in any and all media. In our view, this central shift is the reason that computers will be the first technology beyond print to have a profound impact on the very nature of learning.

We urgently need to change our curricula to prepare children for their future, not for our past. Seymour Papert, professor at Massachusetts Institute of Technology, often says that what our children are currently learning should be called "letteracy," not literacy, since it will equip them for the culture of print but not for the culture in which they will actually live.

For children with disabilities, the change from "letteracy" to literacy will be especially welcome. For many such children, the culture of print has been inhospitable.

The expanded communications toolbox and the adoption of powerful curricula that accommodate individual differences will allow many of them not only to become literate but to excel. Only when the tools for literacy are as varied and flexible as our children will we be able to achieve a literacy that is truly universal.

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**Dr. Anne Meyer** is a licensed clinical psychologist who has specialized for the last 20 years in working with children and adults who have learning disabilities. As teacher, diagnostician, researcher, and author, she has broad experience in the field with a concentration on the emotional aspects of learning disabilities. In 1984, she helped to found the Center for Applied Special Technology (CAST) in order to explore more fully the role that technology might play in helping children to feel more effective and to increase their sense of self-esteem. She now serves as CAST's Co-Executive Director, lecturing throughout the country and writing articles for professional journals and books. As part of her innovative work at CAST, she plays a key role in the design of CAST's multimedia software.