David Reinking

Me and my hypertext:) A multiple digression analysis of technology and literacy (sic)

The computer is much more than a new device for displaying textual information or for teaching children how to read and write. (Note: An electronic version of this article appears in the inaugural issue of Reading Online, *the International Reading Association's electronic journal, at http://readingonline.org.)*

My inspiration for this article comes from the poet and humorist Ogden Nash, who could communicate insightful observations by playing with the meanings of words and texts. He is purported to have once said, "I'm all in favor of change, but there has been way too much of it lately." His clever statement came to mind when I stared at my blank computer screen contemplating what I might say to *The Reading Teacher* audience about the topic of technology and literacy. I thought how Nash's words may ring true to anyone who considers how much technological change has affected modes of reading and writing since 1980, a date that roughly corresponds to the first wave of personal and instructional computing made possible by the development of affordable microcomputers. In 1980 relatively few people sat in front of a computer screen to begin writing prose, let alone to read for edification or enjoyment; and, of course, almost nobody thought about e-mail, hypertext, the World Wide Web, or the need to write a book arguing passionately that books epitomize the experience of reading and that texts presented electronically degrade that experience (Birkerts, 1994).

Birkerts, S. (1994). *The Gutenberg elegies: The fate of reading in an electronic age.* Boston: Faber & Faber.

Extrapolating the rate of change between 1980 and the present into the first decade of the next millennium is enough to give pause to even the most ardent

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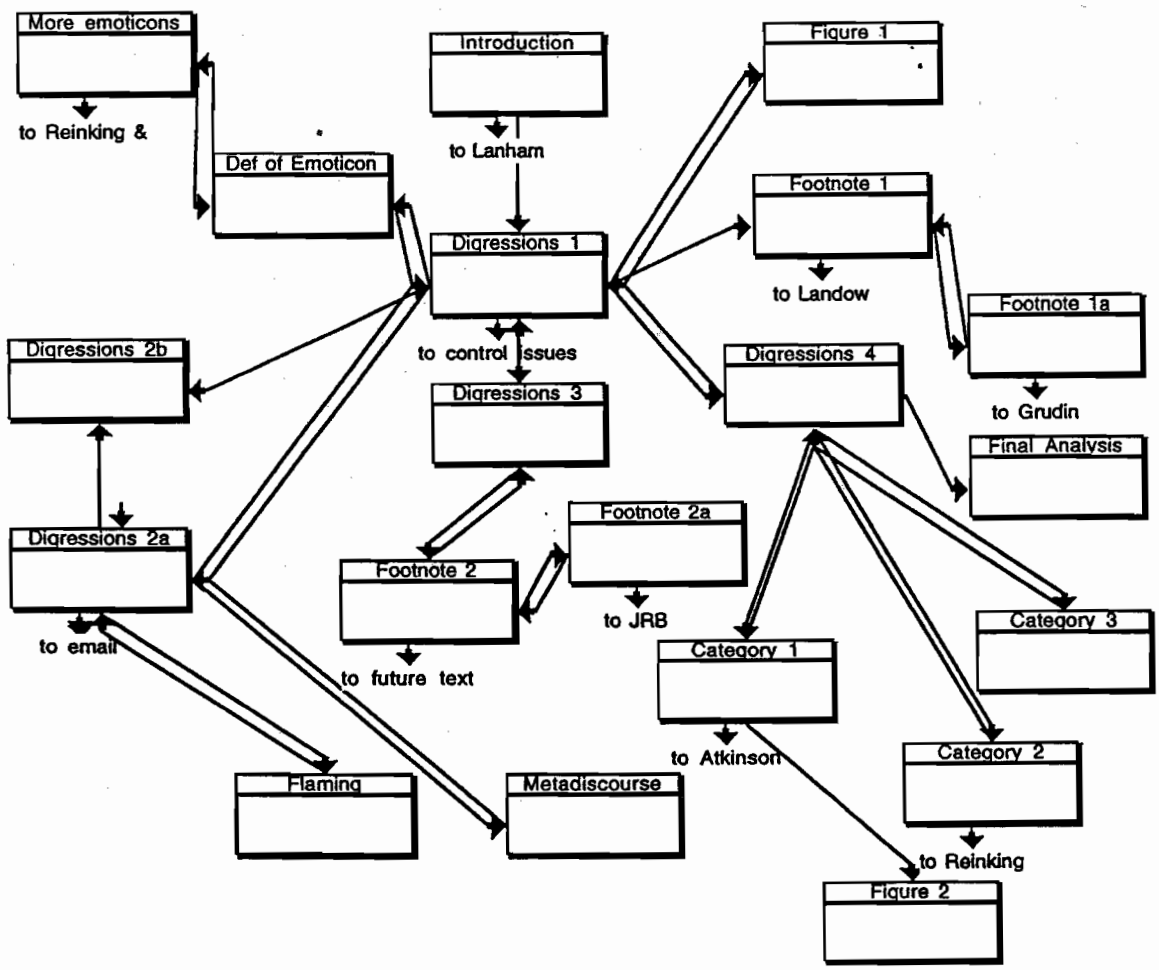
(pp. 626–643)

and adventuresome supporter of technology as a positive force in literacy. For example, a recent *Scientific American* article (Yam, 1995) entitled "Writing on the Fringe" reports a technological development that conjures up some rather bizarre images of what the tools of reading and writing might be like in the apparently not-so-distant future. The article reported that, "[Computer] Hard drives may one day take an atomic twist. Using ultrabrief laser pulses, physicists have demonstrated an ability to manipulate the position of an electron in an atom. Through such control, they expect to craft a kind of atomic video screen, with letters written directly on an atom" (p. 40). I wonder, is there a kind of handwriting instruction that might be relevant for constructing atomic letters? An interesting dilemma, perhaps, for text book publishers if they survive another generation (and maybe an interesting idea for children to talk and write about, too).

Yam, P. (1995). Writing on the fringe. *Scientific American, 273*(4), 40.

Figure 1
Schematic of this article as a hypertext

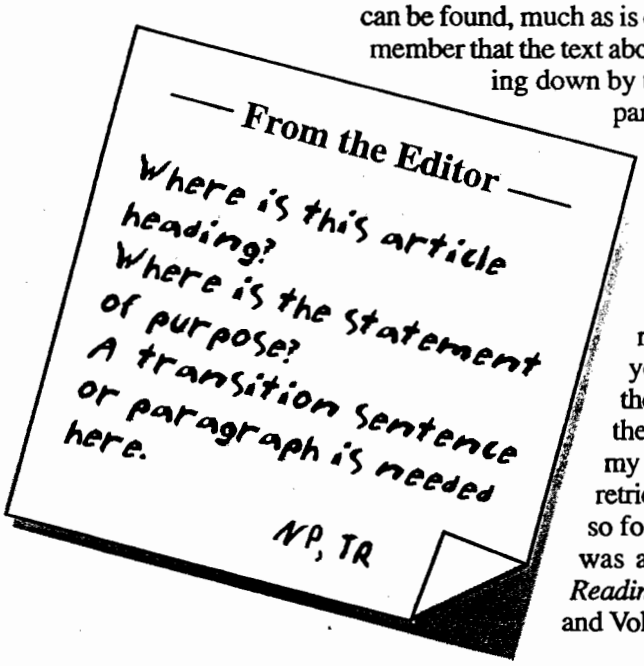


The structure of a hypertext can be much different from a conventional printed text. It is much less linear and hierarchical. In place of ordered superordinate and subordinate ideas there are many branches and pathways that the reader may choose to follow in many different orders. In this schematic the boxes represent segments of texts (primarily prose) and the arrows show links between them and the choices a reader has in following these links. If some of the boxes contained audiovisual effects such as a video clip, the term "hypermedia" might be used in place of "hypertext."

I also thought of this stop-the-world-I-want-to-get-off sentiment when my colleague Jay Bolter at Georgia Tech demonstrated to me his work in developing a concept that might be called virtual reality reading. He is exploring this concept to address a common problem experienced by readers of hypertexts, an increasingly popular term referring to any nonlinear electronic text that provides readers with options to explore links between individual segments of text (see Blanchard & Rottenberg, 1990). Figure 1 shows a map of a hypertext (a representation of this article as a matter of fact, which you will soon discover is meant to simulate a hypertext), and it provides more explanation for readers who may be unfamiliar with the term. The problem is that readers who follow their own interests exploring the links among segments of text in a hypertext often experience difficulty figuring out where they are, how they got there, and how to return to previously read material, a phenomenon often referred to as a "navigational problem," or more colloquially as "getting lost in hyperspace."

Blanchard, J.S., & Rottenberg, C.J. (1990). Hypertext and hypermedia: Discovering and creating meaningful learning environments. *The Reading Teacher, 43,* 656 – 661.

To address this problem, Jay developed hypertexts presented through the technology of virtual reality. To read these hypertexts, readers put on special goggles through which they view a textual landscape presented as a three-dimensional vista of what appears to be buildings in a city skyline. The buildings have labels or billboards corresponding to separate topics, and the buildings are connected by what look like skyways representing meaningful links between the various topics. Using a special glove connected to a computer, a reader can "fly" around the city exploring the texts on various topics and their interrelationships. The rationale for using virtual reality is that readers can create mental images that identify landmarks where particular texts can be found, much as is done in learning one's way around a city. For example, "I remember that the text about Ben Franklin's early ideas about electricity is in the building down by the river next to the large amphitheater." To read a text on a particular topic one might use the glove to enter the building and read texts displayed on the walls of various rooms that also provide points of reference.



My incredulity in imagining that anyone would ever want to read this way was modified somewhat when it occurred to me that despite the uncomfortable image of being a character in the movie *Lawnmower Man,* this type of reading was quite similar to what I had done religiously many years ago when I was a doctoral student reading journals in the University of Minnesota library. An interesting reference in the middle of reading one journal would lead me to get out of my seat at a table, move into the stacks of shelved journals, and retrieve the article of interest, which led me to another article, and so forth. Following the links from one reference to another also was aided by physical reference points. "Now let's see, *The Reading Teacher* is shelved next to the big desk around the corner, and Volume 25 has the red cover about the middle of the shelf."

Digressions (1): An explanation of the introduction (i.e., a response to the editor)

I chose to introduce this article with Nash's quote and two futuristic examples because I anticipated that I might be able to digress from them to make several useful points about technology and literacy (an obligation I take seriously since that's what the editors invited me to write about, and in a published article one can't typically digress too much without being accused of lacking a clear focus, a tight organizational structure, and an easy-to-follow argument). I was also so bold as to think that some of Nash's cleverness might rub off on my own efforts. But another rea-

son I decided to use digression as the organizing (disorganizing?) concept of this article is because I find myself increasingly seduced by the concept of hypertext as an extended metaphor to guide much of my writing, reading, and even my thinking.

Thus, I think hypertext is a particularly good example of how a technology of reading and writing always affects the way we communicate and disseminate information, how we approach the task of reading and writing, and how we think about helping people to become literate. In fact, multiple digressions (e.g., repeated inclusion of parenthetical content[1]) might be considered a defining attribute of hypertext. It's the type of reading many of us occasionally experience when looking up something in the encyclopedia. On the way to looking up one topic we find ourselves digressing to other related or sometimes marginally related topics. (I wonder why I always feel guilty doing so. Maybe it has something to do with the fact that I once really believed my English teachers who convinced me that expository writing was good only when it was preceded by stacks of notecards and an outline.) Trying to write a hypertext means being free to digress and to assume that readers will willingly share in that same freedom. Digression can be positive and enjoyable in a hypertext because there is no compulsion to stick closely to only one main idea.

[If you are reading the printed version of this text, you are advised to look at the footnote now. This advice would be moot if you were reading a version displayed by a computer because I could arrange things so that the subsequent text would be unavailable until you had examined the information in the footnote. Doing so is an example of how digital texts expand the boundaries of freedom and control in accessing textual information. If you are keenly interested in reading more on how digital texts expand the boundaries of freedom and control, stop reading now, go to a university library, and look up the following references: Daniel & Reinking, 1987; Reinking, 1995; Reinking, Pickle, & Tao, 1996. I hope they are not checked out or missing. Of course, if you are reading the electronic version of this text, you could simply click on the references themselves, which might be highlighted in blue to indicate they are available immediately at your command (colors are too expensive to include here), if I could get permission from the copyright owner to display them. See (click on?) Reinking (1996) for a discussion of how conventional understandings of copyright inhibit scholarship in digital environments. Are you getting the idea that you will have to use your imagination to experience this article as a hypertext?]

Readers of this text printed as a journal article are encouraged to view it as one might view a computer program with a main menu with branches to a variety of topics or points of information related to the general topic of technology and literacy. A menu invites personal choice and nonlinear reading. You probably take this approach at least occasionally; for example, you might read the abstract of a journal article and then go directly to the discussion section. But you probably realize that by doing so you are working against the way the article was written. Not so here. In fact, I encourage you to jump around because the digressions are loosely connected and designed for a diverse audience. Here is my main menu to guide your choices:

1. Click here if you are most interested in ideas related directly to using computers in classrooms (or go to the section entitled Digressions 4).
2. Click here to find out more about me and my perspectives (or go to Digressions 2b).
3. Click here if you think books are always the best thing to read and you'd like an opposing view to get your blood pumping (or go to Digressions 3).

[1] A footnote, too, is a feature of printed texts representing digression or parenthetical material. In hypertexts footnotes are not needed because in one sense a hypertext is nothing more than footnotes inside of footnotes inside of footnotes, etc. A hypertext, then, is a collection of footnotes that take turns being the main text (see Landow, 1992).[1a]

[1a] It gets a bit awkward to embed footnotes inside of footnotes in a printed text but I'll do it anyway here to make a point. By the way (or should I add another footnote), footnotes made me think of one of my favorite novels, entitled simply *Book: A Novel* by Robert Grudin (1992). It pokes fun at academics and it also inspired my playfulness here because in one part of the book the footnotes become characters organizing a conspiracy to take over the storyline from the characters in the narrative and from the author. This wouldn't be the first time I've read texts where the footnotes were more interesting than the main text.

[Click here] to return to the previous text.

[Click here] to find out more about Robert Grudin's book. Oops, forgot. Never mind.

Landow, G. (1992). *Hypertext: The convergence of contemporary critical theory and technology.* Baltimore: Johns Hopkins University Press.

Grudin, R. (1992). *Book: A novel.* New York: Penguin.

Daniel, D.B., & Reinking, D. (1987). The construct of legibility in electronic reading environments. In D. Reinking (Ed.), *Reading and computers: Issues for theory and practice* (pp. 24 – 39). New York: Teachers College Press.

Reinking, D. (1995). Reading and writing with computers: Literacy research in a post-typographic world. In K.A. Hinchman, D.J. Leu, & C.K. Kinzer (Eds.), *Perspectives on literacy research and practice,* 44th yearbook of the National Reading Conference (pp. 17 – 33). Chicago: National Reading Conference.

Reinking, D., Pickle, J.M., & Tao, L. (1996). *The effects of inserted questions and mandatory review in computer-mediated texts* (Research Rep. No. 50). Athens, GA: National Reading Research Center, Universities of Georgia and Maryland.

Reinking, D. (1996). Reclaiming a scholarly ethic: Deconstructing "intellectual property" in a post-typographic world. In D. Leu, C. Kinzer, & K. Hinchman (Eds.), *Literacies for the 21st century: Research and practice,* 45th yearbook of the National Reading Conference (pp. 461 – 470). Chicago: National Reading Conference.

*emoticon /e-mot'-i-con/ n. (derivative of emotion and icon). An ideographic symbol constructed from mainly punctuation marks combined to resemble human faces or physical objects (e.g., looking sideways at a colon followed by a closed parentheses resembles a smiling face). Used to convey a feeling or emotion in electronic communications such as e-mail. Click here if you are reading the electronic version of this article to see more examples of emoticons. [Unlike here, in a hypertext, or any electronic text for that matter, a rich variety of help in defining words and phrases could easily be accessible to a reader. The meaning of a word could be explicated with video, animation, sound, and text upon demand (using multimedia in creating a hypertext is often referred to as "hypermedia"). The word might also be presented with other conceptually related words that could effortlessly be cross referenced, as opposed to being presented alphabetically with words that happen to share similar spellings as is currently necessary for locating words efficiently in a standard dictionary. Readers especially interested in the connection between technology, reading, and vocabulary might wish to read the work Sharon Rickman and I did (Reinking & Rickman, 1990) where we found that elementary students reading science texts explored the meanings of more difficult words, recalled more of their meanings, and comprehended more content when they read passages displayed by a computer that provided immediate, context-specific assistance with vocabulary.]

Reinking, D., & Rickman, S.S. (1990). The effects of computer-mediated texts on the vocabulary learning and comprehension of intermediate-grade readers. *Journal of Reading Behavior, 22,* 395 – 411.

Bolter, J.D. (1991). *Writing space: The computer, hypertext, and the history of writing.* Hillsdale, NJ: Erlbaum.

Lanham, R.A. (1993). *The electronic word: Democracy, technology, and the arts.* Chicago: University of Chicago Press.

4. Read on or click here if you are interested in more abstract or theoretical ideas (or go to Digressions 2a).

I will mention that at this point in my writing I tried to resist the temptation to digress further to make the point that technology and literacy are always closely intertwined. Computers have initiated a new interest in the connection between technology and literacy, but historically that connection is not new. Cuneiform tablets, scrolls, the printing press, books, pencils, and pens are technologies that have had quite specific effects on reading and writing. For example, Bolter (1991) points out that when written texts were displayed on scrolls writers restated ideas often because they knew how difficult it would be for readers to "rewind" in order to consult an earlier portion of the text.

The connection between technology and literacy seems to be a new topic because, previously in our lifetimes, the technology of print was unchallenged. Like a fish that is unaware of the water in which it swims, the technology of print and its effects on us have been transparent (see Digressions 3). Electronic forms of reading and writing begin to make technology's effects on literacy opaque. For example, many people report a conscious awareness of changes in their writing when they become competent users of a word processor or when they begin to regularly use e-mail. The *emoticon** inserted in the title of this article, for example, is conspicuous because it is out of place in the title of a formal printed article, but it is right at home in an e-mail communication that, like other forms of electronic prose, is by nature more informal, conversational, and visual (Lanham, 1993, for example, argues that we look more at the visual appearance of electronic texts as opposed to through them).

Such awareness may lead us to reflect about how technology affects reading and writing, which in turn affects our conceptions of literacy and how it should be taught. For example, what guidelines might we teach students to follow in composing and reading e-mail messages? Is proofreading for accurate spelling as critical in that medium? It doesn't seem to be, even among highly educated users. Why don't they seem to be as concerned about spelling in e-mail messages? [At this point, I might ask some of my students to add links to my hypertext explaining the historical reasons for standardizing spelling around the time of Noah Webster.] Should we be teaching conventions for composing e-mail messages as we do the components of a formal letter?

But I digress indiscriminately, so on to a more discriminant digression analysis.

Digressions (2): Meet the author and his text (i.e., me and my writing)

Digressions (2a).

Reinking is Professor of Education at the University of Georgia where he serves as the head of the Department of Reading Education. He is also a principal investigator with the National Reading Research Center funded through the Office of Educational Research and Improvement by the U.S. Office of Education. He is currently the editor of the *Journal of Literacy Research.* Reinking's primary research interest is in the connection between technology and literacy. His publications in that area have appeared in highly regarded outlets such as *Reading Research Quarterly, Journal of Reading Behavior,* and the *Handbook of Reading Research.* He edited a volume entitled *Reading and Computers: Issues for Theory and Practice* (published by Teachers College Press) and is currently lead editor for a volume entitled *Literacy for the 21st Century: Technological Transformations in a Post-Typographic World* (to be published by Lawrence Erlbaum). Previously, Reinking taught language arts for 8 years as an elementary school teacher.

A brief biographical sketch like this customarily accompanies scholarly publications, and indeed the editors wanted one to accompany this article. I wrote it myself, consciously composing it to seem as if someone else wrote it about me. One of its thinly veiled purposes is to impress upon readers that I am qualified and worthy to claim several of the precious pages in a journal and to adopt the authoritative voice publication in print invites. As this practice suggests, the author of a printed text, especially an academic one, typically takes on the persona of an impersonal authority; after all, "author" and "authority" are joined etymologically at the hip. Therefore, to play the role of a conventional author, one (I) typically must assume an impersonal authoritative voice that attempts to mask personal (my) biases and present a single internally consistent argument. Thus, tentativeness and self-doubt are not typically consonant with printed texts, at least published ones. To write like an author of a printed text, one (I) must write like an authority, which means working to construct (convey the image of?) a formidable edifice of unassailable meaning.

For those of us who have figured out strategies for getting ourselves published, writing as an authority begins to feel comfortable and natural. The technological constraints of printing (more accurately the costs) sustain the belief that only lofty thinkers or those who can manipulate language skillfully to portray that image rise above the masses to be published. Grandiose pronouncements can be made authoritatively in print without the worry that just anyone can easily take issue with them or call into question one's (my) objectivity. This idealized, and sometimes idolized, conception of an author is probably what explains the sense of occasion and intrigue we experience in meeting an author in the flesh. And it should be pointed out (i.e., I'd like to point out) that this perception is a good example of how the technology of print shapes our perceptions of what it means to read and write.

But electronic reading and writing invite a much less formal, honest approach to writing, because whether authors (I) like it to or not, they are (I am) much less remote. Consider, for example, what happens when I provide the following information, which is becoming increasingly common in printed articles and would almost be considered mandatory in an electronic one:

dreinkin@coe.uga.edu [click here to send me an e-mail message]

Suddenly, I've become easily accessible to thousands of readers some of whom might take issue with what I've written here and who now have the power to express their views directly to me and to others. Now, that's an inspiration for honesty and informality and humility. Something else could happen too, especially if readers were linked on a listserv or bulletin board discussion group. What I've written might become not a final indisputable and unchangeable document but only the initiation of an ongoing dialogue and explication of ideas. The authoritative finality of this article as a printed document would be subverted, being replaced by a democracy of ideas in which, by definition, many more individuals participate. Writing in such an environment becomes inherently collaborative, as opposed to the manufactured collaboration we create in classrooms where we often conceptualize writing as essentially a solitary activity.

In fact, I find it ironic that some individuals resist the idea of integrating computer technology into their conceptions of literacy by arguing that computers are dehumanizing or that they undermine the democratic values of universal literacy we cherish. That argument seems plausible, I think, only if we do not seriously consider how the technology of print may by comparison also limit the furthering of humane and democratic goals. The recent actions taken by some repressive governments to limit citizens' access to the Internet illustrate how electronic texts are strong agents of freedom.

As one slogan goes, "information strives to be free," and it is clearly much more likely to achieve that status when information is communicated in digital

rather than printed form. Biases against linking computer technology and cherished notions of literacy are also reinforced by a dominant theme in literature and film. Stanley Kubrick's menacing HAL in *2001: A Space Odyssey,* Charlie Chaplin's comical victimization by machines in *Modern Times,* and H.G. Wells's compliant Eloi in *The Time Machine* all play on our fear of vulnerability and possible subservience to sophisticated technologies we may not fully understand and therefore feel we cannot control. To many people, I think, the computer embodies a uniquely powerful representation of that fear, which leads them to ignore computer technology's more potentially liberating and benign attributes.

This shift in power is but one example of the broad implications of electronic textual forms that may require that literacy be substantively reconceptualized. Conceptually, electronic texts more literally operationalize concepts such as voice, audience, and interactions between a reader and writer, which are largely figurative expressions in printed modes of communication. It isn't hard to experience palpably the concept of audience, voice, and the potential of interaction when one is (I am) poised over the return key ready to distribute an opinionated e-mail message to 1,000 colleagues around the world. It gives new meaning to the biblical injunction "my words shall not return empty to my mouth."

While many implications of this conceptual shift for helping children become literate may require serious long-term reflection, I think we can immediately recognize and enjoy some of its benefits even within the framework of conventional literacy. For example, popular children's authors have gone online to interact in real-time chat rooms with children. Children have electronic pen pals. The literal melding of reading and writing can be enjoyed in electronic fiction that invites students to create their own narrative and even to add new characters and events. We can use electronic forms of communication to encourage students to play devil's advocate with conflicting ideas abandoning the need to write from a single perspective. For example, some of my own students have created a hypertextual version of Little Red Riding Hood's adventures by allowing the reader to move freely between the perspectives of Little Red Riding Hood, the Big Bad Wolf, and Grandma.

In fact, many fields, including our own, might benefit from abandoning a single-minded authorial voice as the model for its scholarly literature, substituting instead a multivocal *metadiscourse** along with an obligation to acknowledge the well articulated opposing views of knowledgeable opponents. What would our great debates look like if participants in a dialog were expected to acknowledge the most prominent opposing views or acknowledge any of their own doubts about evolving ideas? I believe electronic reading and writing has the potential to promote a less authoritative, and maybe a less combative discourse, although one might argue for the opposite effect judging from some of the acrimonious exchanges on many listservs. It may be possible, however, that the prolific defensive *flaming** that afflicts many listserv discussions is analogous to the bright flash of light one sees before a light bulb burns out. In other words, it may be the last gasp of those whose authorial privilege is being co-opted by the more open access of digital communication.

*metadiscourse /click here for pronunciation if you are reading this electronically/ *n.* Writing that reflects upon itself such as the following: "I included this definition because I thought it was an obscure word and wasn't sure of the meaning myself, so I looked it up; somewhat surprised that it fit just what I had in mind, I decided to keep it even though I thought it might project a blatant attempt to appear erudite and unnecessarily obtuse."

*flaming *n.* The act of sending a confrontational e-mail message that is rude or personally insulting.

[But then again, I'm not sure that abandoning strong debate is a good idea; will we lose something important if we abandon the tightly structured narrowly grounded arguments we are used to? Debate can clarify issues too, and there are many debates that do. Rarely, however, do we weigh the costs of such debates. For example, see Edelsky (1990) for a well-formulated argument that takes a different view than the one I express in the previous paragraph.]

Edelsky, C. (1990). Whose agenda is this anyway? A response to McKenna, Robinson, and Miller. *Educational Researcher, 19*(8), 7–11.

Digressions (2b)

I'm still somewhat of a dilettante as a qualitative researcher but one thing I've learned from my more expert colleagues is that researchers should explicitly

share their perspectives and biases in reporting their work. I think this is a useful practice because it humanizes the author. So in this digression I want to continue my shift away from my authoritative voice to provide a more personal glimpse of who I am and how I think about technology and literacy.

First, I admit to being one of those people who are excited about the possibilities of using technology to enhance literacy in schools. But I also like to think of myself as a realist when it comes to using technology in instruction. For example, on more than a few occasions I'm a bona fide technoklutz, a fact that students and teachers who are novices with computers seem to take great comfort in witnessing when I make presentations to them. I can almost hear their thinking aloud: "If this technology guy is having problems changing the bulb in the overhead projector, I guess it's OK for me to have some difficulty with a computer."

Like many people who work with computers but who are not computer scientists, I find them a mix of unceasing frustration and engaging possibilities. I often find myself on the trailing edge of technology hardly figuring out one piece of hardware or software when a new and improved (and often more complicated, bug-ridden) version arrives. But this is the price I am willing to pay for remarkably rapid progress that has produced some compelling and useful contributions of technology to literacy. Like many educators, on balance, I find the possibilities and the positives more often outweigh the negatives.

But, being a realist, I have a healthy regard for and an understanding of some teachers' reluctance to embrace technology. Typically, classroom teachers do not enjoy the same freedom over their time that I do (although I would argue that I too work long hours and put up with considerable stress), and they often have access to fewer technological resources and support. So I have great admiration for teachers who have achieved competence in using computers and who have creatively and effectively integrated them into their teaching. They have done so in most cases by overcoming a host of obstacles ranging from logistical and technological problems to sometimes unenlightened colleagues and supervisors who mistrust any deviance from accepted practice or who have superficial commitments to exploring the use of technology in classrooms. I have found that teachers and colleagues who integrate technology into their teaching in more than perfunctory ways are often those who have been recognized by their peers and supervisors as being exceptionally committed and talented teachers long before they became involved in technology, which might be expected given the sometimes formidable challenges of using technology effectively in classrooms.

I also understand why a sense of frustration, distrust, or fear of the unknown associated with computers leads some educators to be indifferent or even antagonistic towards the idea that the technology of reading and writing is changing and that literacy instruction must change too. Educators who are heavily invested in a conventional conception of literacy may see technology as an unwanted or unnecessary distraction to what they believe to be more pressing issues and goals more central to that conception. Although I understand this position and the standard arguments that often accompany it, I find it increasingly difficult to accept given the rapid changes that are occurring in the way we read and write. I think we are well beyond the threshold of shifting from a world dominated exclusively by print to one in which digital information will compete at least on an equal footing. There are certainly enough longstanding knotty problems in teaching reading and writing that remain unresolved and a host of new developments that merit attention, but I would challenge anyone to identify one that promises more revolutionary consequences or that has the potential to transform or make moot as many traditional topics of literacy instruction (see Reinking, 1995, for a more detailed defense of this position and some examples).

So I hope that no one reading this article will think I'm trying to flaunt my technological expertise, preach an unexamined gospel of technology as the messiah of reading instruction, or make anyone feel guilty for not being thrilled to interact with a computer. On the other hand, I do take the stand unapologetically that the shift from printed to digital forms of reading and writing creates a mandate for all literacy educators to reevaluate traditional conceptions of literacy and literacy instruction in light of this shift.

Digressions (3): Books über alles (i.e., literacy ethnocentrism)

The increasing prevalence of texts displayed electronically on computer screens allows us to discover something important about ourselves as literacy educators. The self-discovery I'm referring to is our deep and abiding prejudice for books, particularly those that tell stories, over other forms of communication and artistic expression. That prejudice is revealed, as is typical of most prejudice, only when longstanding practices and assumptions are challenged; for example, in our case by other media such as television a generation ago or computers today. Prejudice is a strong word with pejorative connotations, but I think it is a fitting term that matches the reactions I regularly observe when I ask students, teachers, and colleagues to at least consider the possibility that electronic forms of reading and writing may have some clear advantages over printed forms and may even some day come to be the predominate mode of reading and writing. Sooner or later in that discussion someone will say something like, "But, I can't imagine anything replacing books" or "I'll always prefer a book over a computer when I read on the beach or at bedtime."

This is not an evil prejudice, of course, and simply reflects our passionate commitment to the many positive dimensions of literacy that have for centuries been symbolically encapsulated in the singular technological artifact we call a "book." It also reflects what behaviorial psychologists used to call "conditioning," and what we now talk about as "lived experience." That is, we have had a lifetime of often intense, pleasurable experiences associated with books, and we are not going to forfeit those associations quickly or easily. But even a positive prejudice narrows perspective and limits opportunity for growth in new directions. It takes some serious reflection and even courage to face the possibility that reading on some type of computer screen may be as endearing to future generations as reading pages in a book has been to ours.

This is not to say that electronic texts are in every way superior to printed ones, but they do have a number of qualities that powerfully expand options for creating and communicating meaning (e.g., Reinking, 1992). And many of the limitations one might cite in terms of their visual display and portability are likely to be only temporary given the likely continuation of already major improvements in these areas over the previous 10 to 15 years.

Reinking, D. (1992). Differences between electronic and printed texts: An agenda for research. *Journal of Educational Multimedia and Hypermedia, 1*(1), 11 – 24.

It may be easier to face the possibility that we have a prejudice for printed over electronic texts if we remind ourselves that prejudice is often based more on unexamined assumptions and personal preferences than on unassailable logic or observable fact. For example, I think our prejudice for books accounts for our indignant perception of and sometimes militant reaction to television as a major deterrent to literacy and particularly to reading books. Yet, 30 years of research has not found any clear evidence that moderate television viewing has had any detectable negative effect on literacy as defined in a variety of ways across studies (Reinking & Wu, 1990). In fact, research has consistently indicated a positive correlation between the amount of television viewed and reading achievement up to about an average of 3 hours a day. Likewise, there is no reason to think that turning off the television alone will lead to more reading of books or magazines

Reinking, D., & Wu, J.H. (1990). Reexamining the research on television and reading. *Reading Research and Instruction, 29*, 30 – 43.

(Neuman, 1991). Infrequently discussed is research suggesting that the amount of time spent talking on the telephone is more strongly associated with decreased reading achievement than is television viewing (Anderson, Wilson, & Fielding, 1988).

I don't mean to suggest that as literacy educators we should necessarily be encouraging more television viewing. On the other hand, there is plenty of data to suggest that the energy we might expend in rallying against TV could be invested more wisely elsewhere, including a consideration of how TV might be exploited to advance the goals of print-based literacy (e.g., Reinking & Pardon, 1995; Shoup, 1984).

The point I'm trying to make here is that I think many literacy educators tend to have a constitutional dislike for technologies and media such as television and computers that are not book-like. I've even wondered if some of us may feel more comfortable with laptop computers because they have a more book-like appearance. Likewise, we tend to be prejudiced against media that do not rely mainly on the alphabetic code. For example, I've heard some literacy educators lament the increasing use of icons that appear on everything from automobile dashboards to street signs, and more recently to computer screens. They don't stop to consider the practical utility of such writing, not to mention the fact that such symbolic communication has much in common with ideographic writing systems such as Chinese, the written language of the world's largest cultural group. Perhaps more importantly it is rare that anyone thinks about whether there might be a reason to consider the reading of icons as a part of literacy instruction.

In short, we might be accused of being ethnocentric in our preference for one technology of reading and writing; that is, the one that entails the use of environmentally threatening processes and materials including the application of toxic chemicals to create alphabetic symbols on dried sheets of wood pulp and rag mush sewn and glued together between reinforced dead organic material. And we may even go so far as to believe that Western forms of written artistic expression, which are in some measure products of this technology (Lanham, 1993), are the standard by which all literate activity should be judged for all time.

The previous paragraph may admittedly be a bit inflammatory, so let me offer a less strident comparison to illustrate my point. When I was an undergraduate in the late 1960s, I got a summer job working swing shift in a factory. That meant working first shift for 6 days and then being off 3 days, working second shift for 6 days, and so forth. So sometimes my "weekend" fell on Wednesday and Thursday instead of Saturday and Sunday. Wednesday and Thursday are perfectly good days, but they just didn't feel like a weekend. This preference has little to do with the respective days themselves. But it has everything to do with conditioned expectations and society's accommodation of them. So too, I think, is the pervasive preference for reading from pages rather than from computer screens.

I see indications that we are beginning to overcome our prejudice for printed over digital texts. For example, Jim Flood (Flood & Lapp, 1995), in his presidential address to the National Reading Conference, argued that conceptions of literacy today must be expanded to include the "visual arts." The Technology and Cognition Group at Vanderbilt University (1994) has introduced the term "representational literacy" to emphasize that a broader range of media and forms of expression must be included in today's conception of literacy. Some elementary schools are expanding their curricula to include media literacy or media education. Obsolete skills such as how to use a card catalog in the library are beginning to be replaced by more functional skills such as keyboarding.

Nonetheless, more needs to be done. Children today need to be taught strategies for doing keyword searches to locate information in large databases, how to

Neuman, S.B. (1991). *Literacy in the television age: The myth of the TV effect.* Norwood, NJ: Ablex.

Anderson, R.C., Wilson, P.T., & Fielding, L.G. (1988). Growth in reading and how children spend their time outside of school. *Reading Research Quarterly, 23,* 285 – 303.

Reinking, D., & Pardon, D. (1995). Television and literacy. In T.V. Rasinski (Ed.), *Parents and teachers helping children learn to read and write* (pp. 137 – 145). Ft. Worth, TX: Harcourt Brace.

Shoup, B. (1984). Television: Friend, not foe of the teacher. *Journal of Reading, 25,* 629 – 631.

Flood, J., & Lapp, D. (1995). Broadening the lens: Toward an expanded conceptualization of literacy. In K.A. Hinchman, D.J. Leu, & C.K. Kinzer (Eds.), *Perspectives on literacy research and practice,* 44th yearbook of the National Reading Conference (pp. 1 – 16). Chicago: National Reading Conference.

The Technology and Cognition Group at Vanderbilt University. (1994). Multimedia environments for developing literacy in at-risk students. In B. Means (Ed.), *Technology and education reform: The reality behind the promise* (pp. 23 – 56). San Francisco: Jossey-Bass.

use a spell checker as part of the writing process, and about writing and corresponding through e-mail. We shouldn't let our preferences for print-based media prevent us from moving in these directions. In fact, I believe literacy educators should be in the vanguard of those lobbying for greater use of digital technologies in schools, because knowing how to deal with digital information is likely to be a large part of what defines literacy in the future.

Digressions (4): Bothering with technology in literacy instruction (why should we?)

Compared with other instructional activities using conventional materials, computer-based activities present a teacher with a formidable array of potential problems. For example, even assuming that a teacher has adequate training or experience to operate a computer and related devices such as printers (an assumption that cannot be made too confidently in most instances), many schools lack the infrastructure to support new technologies. Linda Morra (1995) of the U.S. Government Accounting Office has reported the results of a national survey indicating that while about 40% of U.S. schools report having very or moderately sufficient numbers of computers for instructional use; an equal percent report having inadequate electrical wiring to use them. In short, it doesn't do much good to have a lot of computers if you don't have a place to plug them in.

Morra, L.G. (1995, April). *America's schools not designed or equipped for the 21st century.* (ERIC Document Reproduction Service No. ED 381 153)

Other potential problems might fall into one or more of the following categories: logistical (e.g., How can I allow my students adequate time to explore the World Wide Web when I have only one computer in my classroom or I can get into the lab only once a week?), technological (e.g., Could a network be set up so that my students could easily share their online journals?), financial (e.g., My students could join the chat room discussion with that children's author if my school could afford to buy me a fast modem), pedagogical (e.g., What would be a good way to introduce my students to word processing?), curricular (e.g., How do I integrate word processing into the curriculum and what might be eliminated to make room for it?), and interpersonal or public relations issues (e.g., How can I convince my principal/students' parents/colleagues that having my students use a spell checker is not likely to turn them into poor spellers?). Unlike other activities and approaches that can often be fitted into established instructional niches, computer-based activities must often be built from the ground up.

Given the many obstacles, I have come to realize how remarkable it is that even a small percentage of educators would bother trying to integrate technology into their instruction. I hold in high esteem those teachers who have been successful or who are still striving to do so creatively and effectively. I think they deserve recognition and encouragement from colleagues, supervisors, and parents. And, I think that recognition is more likely to be forthcoming when there is a broader appreciation for the difficulties they must overcome and the importance of involving children in electronic forms of reading and writing.

Thus, it is legitimate, and important, to ask the question "Why bother?" with using computers in classrooms. I don't think that it's valid to reply, like the mountain climber, "Because it's there." I believe that anyone who becomes seriously involved in using computers to enhance literacy in schools (or researching the effects of such activities) ought to be able to respond explicitly to that question. From a strictly pedagogical viewpoint, I think there are at least three reasonable and often overlapping categories of responses. I think these three categories represent a progressive maturity in the use and understanding of technology's role in literacy instruction.

Category one responses and digressions: Helping us do what we've always done (but doing it better). First, the use of computer-based activities might be

justified because they further the longstanding goals of conventional literacy instruction. For example, we might want children to decode more words accurately, we might want them to read more books, or we might want to increase their meaning vocabularies. And we might see the computer as an instructional tool useful in achieving those goals. In fact, this rationale is the one that drove much of the early interest in using computers for literacy instruction (actually dating back to the Stanford Project in the 1960s; see Atkinson & Hansen, 1966—I wish you could click here to display Atkinson's article describing this computer-based early reading program which he said was designed "to replace the reading teacher" along with George Spache's 1967 indignant reply to that goal published in a subsequent issue of *Reading Research Quarterly*). This emphasis is understandable because significant new technologies are typically viewed first in terms of how they can enhance existing technologies and tasks. For example, the first automobiles were described as "horseless carriages," based on a familiar technology of transportation at the turn of the century.

Atkinson, R.C., & Hansen, D.N. (1966). Computer-assisted instruction in initial reading: The Stanford project. *Reading Research Quarterly, 2,* 5 – 26.

Spache, G.D. (1967). A reaction to "Computer-assisted instruction in initial reading: The Stanford project." *Reading Research Quarterly, 3,* 101 – 109.

In any event, through most of the 1980s literacy educators and researchers mainly conceptualized the new microcomputer as a device with potential to enhance conventional instructional activities and goals. The commercial software for elementary school children consisted mainly of drill and practice programs often in game-like formats aimed at teaching or reinforcing conventional literacy skills (Reinking & Bridwell-Bowles, 1991; Smith, 1984). Also popular, almost immediately, were word processing programs and other programs that allowed students and teachers to create refined printed documents. This initial focus on printed products can be compared to today's word processors, which enable users to create digital multimedia documents that might, for example, be exported to a page on the World Wide Web. (See Figure 2.)

Reinking, D., & Bridwell-Bowles, L. (1991). Computers in reading and writing. In R. Barr, M.L. Kamil, P.B. Mosenthal, & P.D. Pearson (Eds.), *Handbook of reading research* (Vol. 2, pp. 310 – 340). New York: Longman.

Smith, F. (1984). *The promise and threat of microcomputers in language education.* Victoria, BC: Abel Press.

Research during this period also focused on determining how computer-based activities compared with conventional activities and materials in furthering traditional curricular goals (Reinking & Bridwell-Bowles, 1991). For example, a popular question was "Would children become better writers using a word processor when compared with children who wrote with more conventional materials?" Such a question seems less critical today when word processing is a mainstream technology for writing and when few educators would consider not using it at all or only for the purpose of helping students to write better with a pen, pencil, or typewriter.

Using computers to address the conventional goals of literacy remains a legitimate rationale because printed materials will undeniably be around for quite some time and because many traditional goals associated with print-based literacy carry over into digital forms of reading and writing. However, given the array of challenges facing someone who wishes to integrate computers into instruction, I believe this rationale must also specify what pedagogical advantage the computer offers. In other words, why go to the trouble of using a computer to accomplish something that is just as easy or easier to accomplish without one? In response to that question, I most often hear generic justifications about the com-

Figure 2
An example of a multimedia document created for the World Wide Web using a conventional word processing program

[SORRY, THE QUICK-TIME MOVIE IS NOT AVAILABLE IN THIS MEDIUM.]

puter's capability to track students' learning, provide immediate feedback, increase motivation, or individualize instruction.

These are important and useful advantages, but there are others more specific to literacy instruction. For example, one of the most potentially consequential advantages for early reading instruction is that the computer has the capability of flexibly linking synthesized or digitized speech with typed text. I find it remarkable that more people in our field have not recognized and explored systematically the tremendous pedagogical implications of a technology that can provide readers upon demand with an audible pronunciation of a word that is unfamiliar during independent reading (not to mention a wide range of other useful assistance; see Reinking, 1988; Reinking & Rickman, 1990, Reinking & Schreiner, 1985; Salomon, Globerson, & Guterman, 1989). This capability is comparable to having a more competent or knowledgeable reader available constantly at one's beck and call.

A relatively small group of researchers has had longstanding interest in the capability of the computer to provide audio assistance in reading words (see McConkie & Zola, 1987, for an early example). Some of the best theory-based experimental research involving computers to date has investigated how this capability might contribute to beginning readers' decoding abilities and fluency (Olson & Wise, 1987; Reitsma, 1988: Roth & Beck, 1987). Improvements in computer technology and a broader conceptualization of literacy instruction have continued to provide new options in this area. For example, in a project headed by my colleague Michael McKenna (McKenna, Reinking, & Labbo, in press; McKenna, Reinking, Labbo, & Watkins, in press), we are beginning to explore whether children might increase their sight word vocabulary while reading computerized versions of popular children's books supplemented with various types of audio assistance in decoding unfamiliar words (see also Miller, Blackstock, & Miller, 1994).

This application illustrates the potential for technology to make moot some of our field's most strident debates and to transform longstanding concepts and research questions pertaining to literacy. If, as is conceivable, children could increase their decoding ability naturally in meaningful contexts while reading enjoyable literature, strong advocates of whole language or decoding might find common instructional ground. Traditional conceptions of readability also are muddied when children have access to assistance that allows them to read materials closer to their listening comprehension. Should such access "count" in defining independent, instructional, and frustration levels of reading?

Hypertexts raise similar issues. For example, it has been pointed out that hypertexts tend to blur the distinction between reader and author (e.g., Landow, 1992; Reinking, 1995). Readers of hypertexts participate as authors when they select pathways through a variety of linked textual nodes. Some hypertexts go further by encouraging a reader to revise or add textual nodes (e.g., *Marble Springs* by Deena Larson, 1993). Thus, dealing with textual information presented as a hypertext is naturally a whole language activity. Likewise, it is difficult to imagine a passive or disengaged reader hopping around the World Wide Web, the mother of all hypertexts, following links of personal interest. But then we must ask what strategies might be effective for reading in such environments? Are the strategies we teach children for reading and learning from printed texts needed or effective in reading hypertexts?

Category two responses and digressions: Preparing children for the future (because it's here). Here and elsewhere (i.e., Reinking, 1994, 1995), I argue for the need to broaden conceptions of literacy beyond printed materials. [If you were reading this text in electronic form, it would be possible to investigate these previous writings through a keyword search using *Reinking* and *electronic literacy.* Theoretically you could find every instance of my writing on this topic in just a

Reinking, D. (1988). Computer-mediated text and comprehension differences: The role of reading time, reader preference, and estimation of learning. *Reading Research Quarterly, 23,* 484 – 498.

Reinking, D., & Schreiner, R. (1985). The effects of computer-mediated text on measures of reading comprehension and reading behavior. *Reading Research Quarterly, 20,* 536 – 552.

Salomon, G., Globerson, T., & Guterman, E. (1989). The computer as a zone of proximal development: Internalizing reading-related metacognitions from a reading partner. *Journal of Educational Psychology, 81,* 620 – 627.

McConkie, G.W., & Zola, D. (1987). Two examples of computer-based research on reading: Eye movement monitoring and computer-aided reading. In D. Reinking (Ed.), *Reading and computers: Issues for theory and practice* (pp. 97 – 108). New York: Teachers College Press.

Olson, R.K., & Wise, B.W. (1987). Computer speech in reading instruction. In D. Reinking (Ed.), *Reading and computers: Issues for theory and practice* (pp. 156 – 177). New York: Teachers College Press.

Reitsma, P. (1988). Reading practice for beginners: Effects of guided reading, reading-while-listening, and independent reading with computer-based speech feedback. *Reading Research Quarterly, 23,* 219 – 235.

Roth, S.F., & Beck, I.L. (1987). Theoretical and instructional implications of assessment of two microcomputer word recognition programs. *Reading Research Quarterly, 22,* 197 – 218.

McKenna, M., Reinking, D., & Labbo, L. (in press). *The effects of electronic trade books on the decoding growth of beginning readers* (Research Report). Athens, GA: National Reading Research Center, Universities of Georgia and Maryland.

McKenna, M., Reinking, D., Labbo, L., & Watkins, J. (in press). *Using electronic storybooks with beginning readers* (Instructional Resource). Athens, GA: National Reading Research Center, Universities of Georgia and Maryland.

Miller, L., Blackstock, J., & Miller, R. (1994). An exploratory study into the use of CD-ROM storybooks. *Computers in Education, 22,* 187 – 204.

Larson, D. (1993). *Marble Springs* [Computer software]. Cambridge, MA: Eastgate Systems.

Reinking, D. (1994). *Electronic literacy* (Perspective in Reading Research No. 4). Athens, GA: National Reading Research Center, Universities of Georgia and Maryland.

few seconds even if my writings were encyclopedic—or perhaps more appropriately consumed megabytes of memory.] Reading and writing electronically adds entirely new dimensions to literate activity, and we must consider how best to prepare children to participate successfully in an increasingly digital world. This position is the basis for a second, more forward looking, more informed category of responses to the question "Why bother with technology in literacy instruction?" That is, we bother because we recognize the need to initiate children systematically into the emerging world of digital communication with some sense of anticipation about what that world might be like as they move toward adulthood.

For example, I think the reason some schools and teachers have added keyboarding and word processing to the curriculum is because they recognize that competencies in these areas are now essential. Likewise, even young children are becoming acquainted with how to seek out information in computer databases when they visit libraries where computers have replaced card catalogs. Some schools and teachers are also introducing students to search strategies for finding information in multimedia encyclopedias.

Some research has also explored how children might become initiated into the new digital world, and this research can provide guidance for teachers. For example, Elizabeth Sulzby (1994) has investigated how the concept of emergent literacy might be applied to young children who are given opportunities to write with computers. In our own work at the National Reading Research Center, my colleague Linda Labbo has directed a 2-year project to collect ethnographic data in kindergarten classrooms where she observed the ways that a computer became an informal literacy tool for the teacher (Labbo, Reinking, & McKenna, 1995) and how kindergarten children's spontaneous use of the computer for literacy activities fell into distinct categories (Labbo, 1996) described metaphorically in terms of the computer screen as landscape to be explored, as canvas to be painted, as playground, and as a stage to narrate plays.

Sulzby, E. (1994, December). *Emergent writing on and off the computer: A final report on project CIEL (Computers in Early Literacy).* Paper presented at the meeting of the National Reading Conference, San Diego, CA.

Labbo, L.D., Reinking, D., & McKenna, M.G. (1995). *Incorporating a computer into the classroom: Lessons learned in kindergarten* (Instructional Resource No. 20). Athens, GA: National Reading Research Center, Universities of Georgia and Maryland.

Labbo, L.D. (1996). A semiotic analysis of young children's symbol making in a classroom computer center. *Reading Research Quarterly, 31,* 356–385.

Another example is the work of Rob Tierney and his colleagues, who studied the effects of providing high school students with instruction and regular access to state-of-the-art hardware and software to use in their school work over several years (Tierney et al., 1992). One of the students' comments about his writing after 2 years in the project is worth noting:

Tierney, R.J., Kieffer, R.D., Stowell, L., Desal, L.E., Whalin, K., & Moss, A.G. (1992). *Computer acquisition: A longitudinal study of the influence of high computer access on students' thinking, learning, and interaction* (Apple Classrooms of Tomorrow Report No. 16). Cupertino, CA: Apple Computer.

> Now I incorporate graphics with my text a lot more. I relate it or I try to link it together so that it looks like one unit...I try to make it look more aesthetic and I try to have it more pertinent to what the text is...the things we created weren't really something that could be done on a page...it was something you had to become involved with...it makes it more non-linear sometimes. (p. 4)

I have proposed four criteria that would ideally be met when implementing instructional activities aimed at fostering electronic literacy (Reinking, 1994). One criterion, at least for the present, is that we should seek out activities that bridge the page and the screen. In other words, ideal computer-based activities would relate in some familiar way with print-based activities, which are still more familiar even to young children. A multimedia encyclopedia is a good example because it is at once similar to and different from a conventional set of printed volumes. A second criterion is that activities should focus on authentic communication and meaningful tasks. We don't need to create worksheets on how to communicate via e-mail; we need to give our students opportunities to send and receive e-mail. A third criterion is that activities aimed at enhancing electronic literacy should be accompanied by opportunities to discuss differences between print and electronic media. For example, "How is the wordless picture story we just viewed on the computer screen (see *Amanda Stories* by Goodenough, 1991) like or unlike wordless picture stories we've read in books?" Finally, activities would ideally allow stu-

Goodenough, A. (1991). *Amanda stories* [Computer software]. Santa Monica, CA: Voyager.

dents and teachers to develop strategies for reading and writing electronic texts. Having an opportunity to use a spell checker in place of a dictionary may lead to new strategies for writing, less inhibited by a concern for spelling.

Category three responses and digressions: Using technology to transform literacy instruction (to become or not to become). A third set of responses to the question "Why bother with technology in literacy instruction?" entails viewing technology as an especially effective means of transforming typical modes of teaching and learning toward more positive outcomes. For example, I might argue that providing easy access to the World Wide Web in classrooms might encourage teachers and students to rely less on textbook-centered activities and rote learning of content in isolation, which in turn might facilitate richer discussions of text and more critical reading. Or a curriculum director might become convinced that having teachers use a variety of computer-based writing tools may promote the principles of process writing among language arts teachers in a district. Likewise, a teacher might introduce students to e-mail to increase opportunities for reading and writing for authentic, meaningful purposes. Or a teacher might have students create hypermedia documents to foster more collaborative writing. Such goals imply more than a perfunctory use of computer-based activities that are viewed only as supplementing conventional instruction (a distinction Papert, 1993, makes using Piaget's concepts of "assimilation" versus "accommodation").

This category raises some complex issues and ambivalent research findings that must be highlighted to appreciate its significance. First, there has been a strong belief among many educators that computer technology has unprecedented potential to transform longstanding organizational patterns and instructional approaches in schools (Cuban, 1993; Haas & Neuwirth, 1994; Newman, 1990; Papert, 1993; Sheingold, 1991). Yet there is little evidence that technology is having any widespread effect in transforming instruction (e.g., Means, 1994; Means et al., 1993). Papert (1993) has explained this lack of transformation by arguing that a computer is fundamentally a subversive device in schools and that schools react like "a living organism defending itself against a foreign body" (p. 40). He points out that this phenomenon is not an overt campaign against technology but simply the consequence of seemingly benign actions such as placing all of a school's computers in a single room where students and teachers may have access to them for no more than an hour a week (see Neilsen, in press, for an example of how technology can be overtly subversive of authority in schools).

One point is clear: Technology itself is neutral (Cochran-Smith, Kahn, & Paris, 1990; Mehan, 1989; Weir, 1989; Zorfass & Remz, 1992). Even the most innovative software application is not likely to transform instruction if its purpose is not understood and if it is not implemented in a manner consistent with the pedagogical transformations it was designed to facilitate. An important corollary to this premise is that computers are not inherently better suited to one approach to literacy instruction over another. For example, I think the rhetorical question asked by my colleague Linda DeGroff (1990) several years ago in an article entitled "Is There a Place for Computers in Whole Language Classrooms?" said more about how computers had most often been used until that point (i.e., for drill and practice of isolated skills) than about computers themselves. As Arthur Ellis (1974) said many years ago, "the computer is a machine that can become a machine." What it does and how it is used, therefore, reflects *our* imaginations as guided by our values and philosophical stances (see also Miller & Burnett, 1987).

A rich base of qualitative research speaks to these issues, much of which has been conducted in the area of literacy instruction in the elementary school. For example, one of the most carefully designed and extensively researched uses of technology aimed at transforming literacy instruction has been the QUILL pro-

Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer.* New York: Basic Books.

Cuban, L. (1993). Computers meet classroom: Classroom wins. *Teachers College Record, 95,* 185 – 210.

Haas, C., & Neuwirth, C.M. (1994). Writing the technology that writes us: Research on literacy and the shape of technology. In C.L. Selfe & S. Hilligoss (Eds.), *Literacy and computers: The complications of teaching and learning with technology* (pp. 319 – 335). New York: Modern Language Association.

Newman, D. (1990). Opportunities for research on the organizational impact of school computers. *Educational Researcher, 19,* 8 – 13.

Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. *Phi Delta Kappan, 73,* 17 – 27.

Means, B. (Ed.). (1994). *Technology and education reform: The reality behind the promise.* San Francisco: Jossey-Bass.

Means, B., Blando, J., Olson, K., Morocco, C.C., Remz, A.R., & Zorfass, J. (1993). *Using technology to support educational reform.* Washington, DC: U.S. Department of Education.

Neilsen, L. (in press). Coding the light. In L. Neilsen & J. Willinsky (Eds.), *Coding the light: Gender, generation, and technologies of metamorphoses.* New York: Teachers College Press.

Cochran-Smith, M., Kahn, J., & Paris, C. (1990). Writing with a felicitous tool. *Theory Into Practice, 29,* 235 – 245.

Mehan, H. (1989). Microcomputers in classrooms: Educational technology and social practice. *Anthropology & Education Quarterly, 20,* 4 – 21.

Weir, S. (1989). The computer in schools: Machine as humanizer. *Harvard Educational Review, 59,* 61 – 73.

Zorfass, J., & Remz, A.R. (1992). Successful technology integration: The role of communication and collaboration. *Middle School Journal, 23*(5), 39 – 43.

DeGroff, L. (1990). Is there a place for computers in whole language classrooms? *The Reading Teacher, 43,* 568 – 572.

Ellis, A. (1974). *The use and misuse of computers in education.* New York: McGraw-Hill.

Miller, L., & Burnett, J.D. (1987). Using computers as an integral aspect of elementary language arts instruction: Paradoxes, problems, and promise. In D. Reinking (Ed.), *Reading and computers: Issues for theory and practice* (pp. 178 – 191). New York: Teachers College Press.

ject initiated and researched primarily by Chip Bruce and his colleagues (Bruce & Rubin, 1993). QUILL was designed specifically to promote process writing and reading for meaningful purposes in the upper elementary grades, but a major finding across several years and classrooms was that teachers adapted the QUILL activities to fit their more conventional ideas about reading and writing: "rather than the new technology radically reshaping the learning environment, the computers themselves were shaped to fit the already established patterns" (Michaels & Bruce, 1989, p. 12). Similarly, Miller and Olson (1994) found that a first-grade teacher who was enthusiastic about integrating technology into her language arts curriculum advanced her own pedagogical goals for writing when implementing various story writing software into her classroom. Over time, the researchers documented how her use of the software enhanced her instruction but did not move her in new directions despite the possibilities offered by the software.

Bruce, B.C., & Rubin, A. (1993). *Electronic quills: A situated evaluation of using computers for classroom writing.* Hillsdale, NJ: Erlbaum.

Michaels, S., & Bruce, B. (1989). *Classroom contexts and literacy development: How writing systems shape the teaching and learning of composition* (Technical Report No. 476). Urbana, IL: Center for the Study of Reading, University of Illinois.

Miller, L., & Olson, J. (1994). Putting the computer in its place: A study of teaching with technology. *Journal of Curriculum Studies, 26,* 121 – 141.

Interestingly, computer-based activities designed to further more traditional instructional goals may also be implemented in ways that shift the emphasis toward more progressive ideas about literacy. For example, Labbo, Murray, & Phillips (1995-1996) document how one primary-grade teacher was motivated by her literature-based philosophy to modify the use of IBM's *Writing to Read* program.

Labbo, L., Murray, B.A., & Phillips, M. (1995-1996). *Writing to Read:* From inheritance to innovation and invitation. *The Reading Teacher, 49,* 314 – 321.

However, there is some evidence that under the right conditions technology can be integrated into literacy instruction in ways that positively transform teaching and learning away from conventional modes of instruction. For example, in my own work (Reinking & Watkins, 1996), we found evidence that involving teachers and students in creating multimedia book reviews to replace conventional book reports transformed instruction for some but not all teachers in several schools and classrooms. A foundation for the transformation seemed to be that in all cases during this activity, which was perceived by teachers and students as a special instructional event, typical patterns of social interactions were altered. That finding is common among studies examining the effects of using computers in instruction (Sheingold, 1991). Teachers became less directive; there was much more peer interaction and collaboration; and students often took on a different persona when interacting with their peers (e.g., some low-achieving students became the experts in the computer lab).

Reinking, D., & Watkins, J. (1996). *A formative experiment investigating the use of multimedia book reviews to increase elementary students' independent reading* (Research Rep. No. 55). Athens, GA: National Reading Research Center, Universities of Georgia and Maryland.

However, other factors seemed critical in explaining why some teachers in our 2-year study extended the technology and the new perspectives it offered into other areas of their instruction. These factors included the active involvement and leadership of a teacher who assumes the role of technology expert in the school; supportive, collaborative colleagues and administrators who work in an environment that encourages independent thinking and flexibility in meeting instructional needs; and sufficient access to needed hardware and technological support.

Another major research effort that provides insight into how technology can positively transform literacy activities is Garner and Gillingham's (1996) study of how six teachers at various grade levels in different schools around the U.S. integrated e-mail and the Internet into their teaching. Several common findings emerged across the six sites. First, access to e-mail and the World Wide Web created a positive social environment in which students and teachers gravitated toward telling stories, often drawing on their own experiences. In several instances this telling of stories through the medium of e-mail broke down cultural stereotypes by facilitating contact among diverse groups of students. Second, for the teachers and students in these classes the technology became "more or less invisible." That is, it became an unremarkable tool because it was fully integrated into the daily instruction. Finally, they point out that the teachers in each of these sites shared common characteristics:

Garner, R., & Gillingham, M.G. (1996). *Conversations across time, space, and culture: Internet communication in six classrooms.* Hillsdale, NJ: Erlbaum.

> They are not very didactic or teacher-centered in their instruction, they link student interest to subject-matter learning, they view technology as a means rather than an end, and they believe that all of their students can succeed...most of all they each...seek alternatives to current practice. (p. 135)

My vision of how computers might transform literacy in classrooms and beyond is captured by a quote from Sylvia Weir (1989), who writes, "The kind of teaching and learning I am concerned with treats the computer as an adjunct to socially mediated learning, as part of a context, a constellation of children with children at the computer, of teachers with children with computers" (p. 61). In this sense the computer is much more than a new device for displaying textual information or for teaching children how to read and write. It is instead a revolutionary new vehicle for textual communication that, if fully appreciated for its own merits unencumbered by lingering biases for print, can act as catalyst to bring people closer together in a democratic and relentlessly conditional pursuit of knowledge, understanding, and enjoyment. To realize this potential, we will be best served by setting our imaginations free from seeing a computer as a machine that lacks the warmth and security of a book, seeing it instead as a technological alternative providing almost unlimited potential to operationalize the humanistic values that fuel our noblest conceptions of literacy. It will be easier to acquire this perspective as technological advances make computers as portable and user friendly as books are today and as we become more familiar with the alternative ways of reading and writing with them. Hypertext is but one, albeit powerful, construct that captures the possibilities of this new era in literacy, and this hypertext-inspired series of digressions is but a crude imitation of things to come.

In the final (digression) analysis

Printed documents such as books and articles like this one are supposed to have beginnngs, middles, and, most definitively, endings that separate them from other documents. In the world of print, texts must be clearly segmented by physical endpoints (e.g., the back cover of a book) and conceptual endpoints (e.g., the often unimaginative "summary and conclusions" sections at the end of academic articles; see Bolter, 1991, for a discussion of the interplay between what he calls the hard and soft structures of various writing technologies). I will conform to that convention here, which is a somewhat welcome concession to the conventions of print-based writing because it has been a struggle to decide what digressions and connections to include and which to omit, knowing as I wrote that an endpoint is expected and inevitable. And, perhaps my choices have been too digressionary.

So, in closing, I wish to point out in this final digression what is singularly, especially from this writer's point of view, the greatest advantage of electronic reading and writing compared to printed forms. It is an advantage so strongly supported by my own research and by instructional practice that it is incontrovertible and must be taken into account by any educator who undertakes to understand the implications of technology on literacy. This critical advantage I am referring to is of course

— From the Editor —

The editors regret to inform readers that due to strict space limitations, we could not publish the remainder of Reinking's article. Those readers who wish to read the remainder of his article may access it in READING ONLINE, IRA's new electronic journal, where space limitations are less critical.

NP, TR

Author notes

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"I generally approach a question not like this x–>. but like this ➔."
Wittgenstein

Our own stories

I care

Jessica Toth

I remember June 16, the last day of school, like it was merely hours ago. I vividly recall the emotions that ran rampant that day. Some teachers cheered wildly as the last of their students exited the building. Some stood on the front steps of the school, joyously waving at the last of the buses to drive away. Still others chatted noisily about their upcoming summer plans. Then, there were those who cried.

I cried. I cried for many reasons. I cried because I knew I would miss Lisa's smile, Jarod's determination, and Melinda's bright eyes. I cried because of Shawn. Shawn was the one child I was hardest on this year, yet he was the student who hugged me the hardest and thanked me the loudest on the last day of school.

I cried because the students in room 206 and I were like a family. I referred to them as "my kids," and sometimes they referred to me as "mom." From September through June we worked together, played together, read together, and laughed together. We saw each other almost every day. We were close, just like a family.

I cried because I knew I would miss that closeness. I cried because I wish only the best for my "kids," yet I very well know that some won't always have the best. I cried because I am a teacher and I care.

Toth teaches fifth grade at Shoemaker School in Macungie, Pennsylvania, USA.