Chapter 1

Diversity and Critical Social Engagement: How Changing Technologies Enable New Modes of Literacy in Changing Circumstances

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Every other year, my children's high school hosts an event called "lock-in." Students are allowed to spend the entire night in the school talking, eating, dancing, playing games and music, watching videos, meditating, and doing some service activities, such as packing meals for a local shelter. The lock-in is presented primarily as a time for recreation that stretches the usual rules about staying up late and playing in the school, but with teachers and parent chaperones not letting the rules stretch too far. Being there provides a brief glimpse into adolescent life today.

Even in the somewhat artificial setting of the lock-in one can see some of the v cdiversity of roles and activities that young people engage in as we begin the 21st century. Much of what they do reminds me of times when I was their age, but one key difference is the mediation of activities through electronic technologies. This year, in one room, I saw about a dozen students dancing to a music video, all facing towards a video monitor. In another, an even larger group were absorbed viewing Men in Black, one of a continuous series of videos shown that night. These movies relied on production technologies unknown in my high school days, in many cases realizing the possibilities of what were science-fiction notions a generation earlier. Their content likewise embraced a world of computers, gadgets, and high-tech weapons. Many students could be found alone, or in pairs. Some were talking or sleeping, but many were plugged into CD play-

ers, listening to music they had purchased, copied from their friends' CDs, or in some cases, downloaded from the Internet.

I spent some extended time as chaperone in the computer lab. A key assignment was to keep the food out. Food is normally forbidden in computer labs, but with the bending of the rules that night, a number of students thought they could bend the eating rule as well. Another normal rule for the lab is that students are supposed to do only school-related tasks; that is, activities such as word processing, reading email, searching for information on the web, and running simulation programs, but not using chat rooms or playing games. On this special night, that rule was lifted: Students could play games and visit web sites that were normally banned. I got an idea of how special the lock-in time was and how well that rule was enforced when one boy came in saying for my benefit, "Oh, yea! Computer games! It's not like we ever play computer games in the lab when we're not allowed to."

For a good part of my time in the lab there were two main groups. One was a group of boys playing computer action games, such as Warcraft or Quake. Although only one boy was typing at a given time, another might be controlling the mouse. About six others, the number varied as some would move in or out of the group, contributed suggestions and commentary: "Oh, great! You just killed one of the hostages. Back up and do it again."

Meanwhile, another group, this time all girls, were engaged in a quieter, but equally intense activity. When I wandered near, one quickly switched to another site so I wouldn't see what they had entered. It turns out they were at the "Emode" web site,

which has scores of self-discovery tests ("from fun and wacky to downright serious"). Users fill out a multiple-choice questionnaire and receive an evaluation on questions such as "What's Your Celebrity Look?", "Are You High Maintenance?", "Who's Your Inner Rock Star?", "Who's Your Type?", "What's Your Movie Mood Tonight?", and "Are You a Workaholic?" Later, the same girl who had hidden her responses before gave me a tour of the site and shared some of the ratings she and others had received. Emode users can use the site to "link up with friends, share and compare ... test results, and send personalized email invitations," with the implication that through the site one can find a soulmate.

The computer lab was a popular venue throughout the night of the lock-in, even though many of the students had access to computers at other times. As were the other digital technologies in evidence that night, the lab was worthy of the attention of adolescents (Lankshear & Knobel, this volume). Several other observations stood out for me: One was how much the use of the computers constituted a social activity. In many ways there was more talk, shared laughter, and physical closeness in the computer lab than in other activities in the school that night. Another was of course the stereotypical gender divide, both in terms of the particular computer applications being used and in the ways that students interacted with them. It was also striking how much there seemed to be a shared micro-culture around the computers and the specific applications, a millennial culture only partly accessible to the older generation (see Gee, this volume). There was a shared understanding regarding how to use programs or web sites, as well as opinions about which ones were worth using. There was also a common sense of how a group activity was organized, even though this was banned in the normal use of the lab.

A characterization that applies to the computer lab applies to many of the other activities that night as well: Young people were engaged in technology-mediated social interaction. These technologies included CDs and CD players, MP3 files, audio headsets, stand-alone computer games, interactive web sites, email and e-chat, DVDs, tape cassette videos, video players, and monitors. Rather than isolating them, these technologies served as media for interaction among the adolescents. They were boundary objects (Star, 1989) allowing them to connect with each other by means of and through shared artifacts (see the discussion of e-zines in Knobel & Lankshear, this volume). These boundary objects are now integral to the ways that these young people make meaning, communicate, and construct their social lives.

As social life moves into a wired, and now wireless, world, many educators ask whether traditional ways of teaching and learning, which had been developed in an industrial age, are still adequate for a time defined by video, the world wide web, cell phones, wearable computers, and instant messaging. The new technologies thus challenge the educational system, but at the same time support an expanded view of learning, which welcomes change, responds to new media, and extends the classroom to connect with the larger society. In this context, learning based on inquiry seems more needed than ever (see Beach & Bruce, this volume).

If we conceive literacy practices as a set of activities around texts, including understanding and composing, but also the whole complex of social relations and actions related to making and communicating meaning, then literacy becomes inextricable from community, and from the ways in which communities and society change. It is likewise

inseparable from the material means by which knowledge is negotiated, synthesized, and used. This chapter takes a historical perspective on the notion of new literacies (Bruce, 1998), raising the question of how literacies, technologies, and social circumstances co-evolve and what changes in literacy practices mean for adolescents today. It presents first the case that a fundamental transformation is visible already in the literacy practices of young people, but follows that with questions about what this change really means. It then considers a framework for a critical examination of literacy and technology and its implications for research and teaching.

Are New Literacy Technologies Harbingers of a Radically New Literacy?

When asked to say what source they relied on for the last big report they wrote for school, 71% of teens in the United States with Internet access reported that the Internet was their major source, compared to 24% who cited library sources (Lenhart, Simon, & Graziano, 2001). More than half of these teens had used school or class web sites; a third had downloaded study aids, and a sixth had created web pages. Even their parents were getting involved: 28% have used email to communicate with their children's teachers. Today nearly every school in the United States has Internet access and many students have access at home, in libraries, or in community centers as well. Various studies are showing substantial and growing use. For example, a survey by Statistics Canada (2001) found that 61% of households there had a member who spent 20 hours or more a month on the Internet in 2000, compared to 47% in 1999.

One consequence of the growing access to the Internet is that students are increasingly using email, instant messaging, web resource sites, essay sites, online reference tools, online tutoring, and ask-an-expert sites as an integral part of their school work. This for-school use merges with the out-of-school uses such as game playing and chatting with friends, so that a major chunk of adolescents' time each day is now mediated through the Internet.

The life of adolescents is thus already changing as a consequence of the affordances of new media: Using new communication and information technologies, teachers and students are discovering more ways to learn about the world, to express themselves, and to communicate with others. Stories of their classrooms are beginning to appear in books (e.g., Bruce & Rubin, 1993; Garner & Gillingham, 1996; Reinking, Mckenna, Labbo, & Kieffer, 1998), as well as, not surprisingly, on the web. These stories show that dedicated teachers can accomplish extraordinary things with good tools. Research in these classrooms has shown how important it is to understand the new ways of writing in the context of what we know about how people learn, as well as to examine what is needed to achieve the potential of the new media and learning resources. At homes and in after-school programs, these media provide new opportunities for creative expression and community (Garner, Zhao, & Gillingham, in press).

The previous examples provide only hints of what could be fundamental changes in literacy derived in whole or in part from the effects of new communication and information technologies. I discuss these changes below in terms of digital texts, new literate communities, and cultural transformations.

Digital Texts

Only a short time ago, but long enough that I cannot easily envision it, I wrote using a machine much noisier than the one I use today, one without a screen or a mouse. Each key clicked as it impacted the paper and required correspondingly greater pressure to imprint a letter. Today, I am surprised to come across a typewriter in use, even though such machines were the norm for writing just a short while ago. Before the typewriter, I wrote by hand. These have not disappeared, but their functions have changed. For example, longhand still serves well for personal notes and is a hallmark of personal attention in a way that it had not been in the era before mechanical typing.

One is tempted to say that the basic issues of writing have not changed: discussing, planning, organizing, thinking of audience and purpose, and revising are as pertinent as ever. And yet it is already not exactly the same; each new tool subtly changes the practice. For example, I recently wanted to find a citation for Paul Saffo's idea about short-term versus long-term change. In the past, I might have turned to a manila folder containing scraps of paper, or a box of coded index cards. Today, I suspected that a quick check of the world wide web would help me out. I searched for "Paul Saffo" and "short term"; a Google search found 219 documents matching my query. A quick check of the first located an interview (Public Broadcasting System: Frontline, 1995; see also Saffo, 1996), with the following quote, which I could, of course, cut and paste directly into this article:

> ... collectively as a society and as individuals we all suffer from what I call macro-myopia. A pattern where our hopes and our expectations or our fears about the threatened impact of some new technology causes us to overestimate its short

> term impacts and reality always fails to meet those inflated expectations. And as a result our disappointment then leads us to turn around and underestimate the long term implications and I can guarantee you this time will be no different. The short term impact of this stuff will be less than the hype would suggest but the long term implications will be vastly larger than we can possibly imagine today.

Saffo's point applies well to writing. Initial expectations about word processing or the world wide web were often inflated. Only after these tools became integrated into daily practice did we find that we were no longer reading and writing in the same way. The merging of web browsing with writing, and writing with easy editing, to take just one example, has begun to change the writing process in substantial ways for many people. And now, there are new problems: A format checker might have difficulty with my Saffo citation: What is the page number for a quote from a video whose transcript is now posted in a web page? What are the consequences of coming to rely on the ease of searching the web? Is the citation of a web source meaningless for the reader who has no access to the web?

More and more texts are becoming accessible in digital form, with all that implies for rapid dissemination, duplication, indexing, storage, and searching both for and within the text (Burbules & Bruce, 1995). Many texts are now available not just additionally, but primarily, in digital form. This may constitute what Burbules calls "an epochal shift, in the ways we write and the ways we think about the importance of writing" (p. 107).

Thus, changes in writing technologies accompany changes in larger sociocultural contexts. Not only must the teaching of writing change to accommodate these shifts, but

so must teaching and learning in general, inextricable as these are from the available forms of writing. This position is articulated in the introduction to the online journal, Kairos:

> In hypertextual environments, writers are not only learning to strike forcefully in the traditional sense of presenting the correct words in the proper manner, but are also learning to weave a writing space that is more personal than the standard sheet of paper. We are writing differently; we are reading differently; we are learning differently; we are teaching differently. Kairos is a journal that addresses these facts individually and syllogistically. [http://english.ttu.edu/kairos/]

Text is no longer a sequence of alphabetic characters on a piece of paper. Various writers (Barthes, 1985; Foucault, 1980; Kennedy, 1993; Latour, 1998; Lincoln, 1989; Selfe & Selfe, 1994) have shown us that social arrangements, clothing, buildings, new technologies, sports, and so on, can all be read as texts. We are just beginning to see the full implications of this perspective for visual literacy. Moreover, new technologies are making photographs and video images as manipulable, searchable, and writable as alphabetic text. Writing is now seen more clearly as assemblage, rather than creation de novo:

> The modern subject proceeds through life by selecting from numerous menus and catalogs of items be it assembling an outfit, decorating the apartment, choosing dishes from a restaurant menu, choosing which interest groups to join. With electronic and digital media, art making similarly entails choosing from ready-made elements: textures and icons supplied by a paint program; 3D models which come

with a 3D modeling program; melodies and rhythms built into a music program. (Manovich, 1996)

The process of assemblage is aided by the convergence of communication technologies through the Internet (see C. Luke, this volume). Print, images, databases, instant messaging, conferencing, email, fax, radio, video, interactive programs, and virtual reality are now available through a web browser and becoming increasingly interoperable. Access to these tools is becoming possible in the most remote regions (Bruce, in press), not only for readers (one-way transmission), but for writers as well (two-way communication). The new technologies allow anyone to become a producer as well as a consumer. For example, Live365 alone offers over 40,000 radio stations from around the world through the web. Users can create their own radio programs and deliver them through the site.

New Literate Communities

A university student sent the email message below to her class listing various web sites she had found on the subject of writing. Here is part of that message:

> 14.) http://www.venus/net/~emery2/writing.html[1]
>
> This is a site that describes the ideal Writers Workshop from the same elementary school as the previous site. There are tips for success in a workshop and suggestions for organization. It follows very closely with the philosophy of Donald Graves. There are also some links to sample writing from some of the children at the elementary school. If you are thinking about starting Writers Workshop in the classroom, this is a good place to look.

This message fragment is not all that remarkable on the surface, but as we look more closely, it is clear that we are seeing new forms of writing. For one thing, the code on the first line is an address on the world wide web. Using my email program I can click on that address and fairly quickly access the text she is describing. Thus, her email message is a hypertext; its content is only partially contained in the few lines we see here. If we follow the hyperlink, we find ourselves in Madison, Indiana, at the E. O. Muncie Elementary School. We can read there about the approach to writing taken by a class in that school, and even see an example of writing by the student, Polly B.:

> Bunny the Dog
>
> Bunny is my dog and I had to give her away because we were moving. Now I couldn't hate my life more.
>
> My dog's name is Bunny because she jumps a lot and she thinks that if she wiggles her bottom she can stay in the air.
>
> But know I am lucky cause my grandma took her cause if she didn't, Bunny would have to go to the pound.
>
> By Polly B.

Thus, a student, who might otherwise have published her writing on a cork bulletin board within the classroom, is publishing instead to the global community. Her story can be read anywhere in the world. Polly's story thus enriches the university student's message, and in turn adds to my understanding of what the E. O. Muncie School is doing. This could all be done without computers or the world wide web, but the ease of linking

these texts makes possible a remarkable sharing of writing, and consequently, enlarged communities of learning.

Today, I feel a sense of immediacy and a much closer connection between research and writing than I remember from my high school or college days. It feels more natural to write reflecting on my own process of writing. Through the web, I also feel a greater connection to the writing of others. I know that if this text were on the web instead of in a book, there could be a hot link to Saffo's article, even his photo, email address, or the video session of the interview with him. The notion of a community of writers thus seems more real and present than ever before, making Barrett's idea (1989) of a "society of text" more tangible than metaphorical.

Complex projects that call for interdisciplinary collaboration, as well as collaborative support systems known as groupware, are increasingly pointing to professional writing as a collaborative process (see Kouzes, Myers, & Wulf, 1996; Lunsford & Bruce, 2001). The case of the solitary writer in the garret, or more pertinently, the student "doing his/her own work" may soon be seen as the anomalous case for writing. The Emode community is one such new literate community, one in which the social interactions around and by means of the computer represent heightened modes of co-construction of texts and meaning. Even my example of the Saffo quote is a new form of collaboration, in which writers make their texts more accessible and helpful to one another.

Collaboration becomes more salient in the work world as well, when demands for knowledge workers (Drucker, 1994) or symbolic analysts (Reich, 1991) situate workers within communities of practice that support lifelong learning. Proponents of the new

economy argue that the new worker needs to understand the work process and see it as inseparable from continual learning, un-learning, and re-learning. In the new digital economy, work will supposedly be more meaningful than in previous economies based on manufacturing or agriculture. This is certainly occurring to some extent, but Gee, Hull, and Lankshear (1996) have critiqued these claims, questioning the extent to which it happens for the majority of workers.

The new communities have much in common with communities as far back as we can see, but they also exhibit new forms of organization and new practices. Commentators have remarked on the lack of sustained engagement as people move from one place to another and switch jobs frequently. The connections through the web can be meaningful, leading even to marriages, but they also may substitute weak ties for strong ties, time divided into ever finer fragments among more and more people. All of this occurs as many feel an accelerated pace to life, with increased stress. The volume increases, but as McKibben (1993) argues, the apparent deluge of information may obscure the loss of more vital information about nature and human relationships.

Cultural Transformations

Technological developments greatly facilitate the operations of multinational corporations. Online databases, audio and video conferencing, automatic translation systems, and other new media enhance the global reach and local adaptation of world soft drinks, cars, and clothing. Work that was once tied to a particular locale and culture can now be redirected overnight to sites around the world. The growth of these companies leads them to act as supra-governments, controlling the movement of labor and making decisions

affecting the environment, health, housing, and job security. The protests at WTO and G8 meetings reflect the powerlessness that many feel as these supra-governments replace more familiar and (possibly) accessible institutions.

To meet the needs of a multinational environment, many multinational corporations move employees around specifically so that they and their families will develop a "cross-cultural glue" enabling them to acquire "global personalities" (Kaplan, 1997, p. 72). They promote umbrella cultures, intended to transcend local and national boundaries. Whereas political conservatives question multiculturalism, their natural allies in large corporations have become among the major promoters in order to expand markets and establish the complete interchangeability of labor.

Literacy today cannot be understood separately from the increasingly interconnected world in which we live and work. Globalization implies the need to understand the world through the eyes of others as well as through our own situated perspectives. What will be the consequences of a world of "global personalities"? Will it lead to greater peace? To more global understanding? Or do its threats to the cultural strengths and diversities of the world challenge democratic societies? Is democracy, as Kaplan (1997) asks, just a moment in history that will be replaced by other political formations through continuing globalization? If literacy is an expression of culture, what does it mean to create hybrid, umbrella, and technologized varieties?

Meanwhile, the nature of the languages in the world is changing rapidly. Hundreds of languages spoken today may die out over the next century (see Ethnologue, 2001; Terralingua, 2001). At the same time new languages, including many world Eng-

lishes and dialects for technical communication, are proliferating. It is not obvious how the new writing technologies will interact with these changes. Will they help preserve minority languages? Will they hasten the acceptance of English as the world's lingua franca? What will happen to the diverse writing systems now in use around the world, especially the nonalphabetic forms? Will greater international communication lead to more learning of other languages, or will automatic translation systems allow people to remain in their linguistic enclaves, yet still communicate?

Has It All Happened Before?

It seems inescapable that we live in a time of momentous change, with new social roles, massive immigration leading to a multicultural society, globalization, questions about political structures, and new literacy technologies. It is tempting to see our own era as a unique historical moment leading to radically new forms of literacy and even new kinds of people. But a very different stance toward the new technologies (Bruce, 1997) emerges from historical considerations. A century ago, technological change transformed American life much as it is doing today, with each change supplying the conditions for further changes (Malone & Crowston, 1994). The industrial revolution brought factories to the cities and mechanized agriculture to the farms. As workers moved from partially automated farms to run the new factories, urban areas grew rapidly. Railroads, and later the automobile brought distant points together and changed the social order. Advances in printing and the telephone expanded communication practices.

The Turn of the Century

A consideration of the U.S. society at the start of the previous century does not support the view that we are in an unprecedented time of globalization, technological change, and societal disruption. On the contrary, the changes of today all have precursors. Whether we think in terms of literacy technologies, immigration, dependence on foreign trade, social change, or consequences for education and literacy, the evidence favors the early period as being more tumultuous (see Bruce, in press).

On a list of the greatest engineering achievements of the 20th century (National Academy of Engineering, 2000), the computer ranks number 8 and the Internet number 13. Other technologies, most of which emerged in the early part of the century, were judged more significant in terms of "impact on the quality of life." Electrification ranked number one, largely because it enabled most of the other achievements on the list. The automobile, airplane, water distribution, electronics, radio and television, and mechanization of agriculture all ranked ahead of computers. The telephone, which ranked ahead of the Internet, made nearly instant voice communication possible across long distances and directly affects most people today on a daily basis. Radio, television, and motion pictures have likewise had an enormous impact on society.

Technologies most directly related to literacy also saw significant changes in the early 20th century. Lithography, mechanical paper making, and cloth binding along with improved transportation enabled the mass production and distribution of books (Lewis, 1998). Color illustrations made reading more attractive and low cost made it more accessible to a mass audience. Even the mundane tools – such as dependable, low-cost pencils

and pens – have been crucial to changes in literacy practices. It remains to be seen whether computers and the Internet will have a greater, or even comparable, impact.

Along with these technological changes the United States saw a rate of immigration more than double that of recent years. This arguably led to more significant changes in the cultural and linguistic fabric of American life. All of this occurred when globalization was a fact of life. As Smoler (1998) says,

> It is a great and misunderstood fact that globalization is a return to normal for the American economy. Between 1890 or so and 1914, America was the world's biggest trading economy except for Britain. A very large proportion of the economy was either imports or exports. There were massive direct investments, which dwarf the level of foreign investment you see now. (pp. 65-66)

Throughout the period of a century ago there was rapid social change accompanying the technological. Schooling was transformed through the introduction of compulsory education for most children, and the reduction of some class barriers. Struggles for the rights of women, immigrants, Native Americans, and African Americans were at very different stages, but all saw progress during this time.

Implications for Schooling

The combination of new literacy technologies, changes in the workplace, shifting demographics and social relations, and awareness of the international context led to demands for new forms of education. More people began to spend more time in school. Educators recognized the need for learning that was more responsive to new conceptions of knowledge and more attuned to the changing society (Dewey, 1938). Newly industrial-

ized countries that were immersed in a global economy adopted mass literacy as a goal, seeing schools and public libraries (Minow, 1997) as vital to economic development.

During this time, pragmatism supplied a theoretical basis to account for a world in which what we knew changed from day to day. Thus, knowing, more a process than a static object, must grow out of reflection on experience, not simply be imported from some pre-existing structure. The progressive movement in education was built on these ideas, especially Dewey's articulation of the need to build a more inclusive society with methods appropriate to the new contexts for learning. Basing education on ordinary experience opened possibilities for learners and laid the basis for engaged citizenship.

Another force driving these changes was the need to assimilate immigrant and rural workers into an increasingly mechanized and urbanized economy. Libraries and advanced education helped inculcate political and social values seen as needed in a manufacturing-based economy. They shored up the class system as well by delineating the educated elites from the workers. Thus, although new libraries and extended education for the masses created expanded learning opportunities and promoted a democratic society, they also had the crucial function of fashioning "civilized" production workers who could function within a hierarchical system (Bowles & Gintis, 1976). Politicians today focus on education for many of the same reasons they did then. There are calls for restoring fundamental values in schooling and for increased accountability of students, teachers, and schools. Despite the hopes of many educators that new media will open up learning, the major effect may be instead to reinforce the normalizing function of schooling through online learning, computerized testing, and control of publication.

Constancy in the Midst of Chaos

Many of the purported changes of today are less obvious when one examines the evidence more closely. Despite the Internet, or rather because of it, over one billion books were sold in 1999 (Dembeck, 2000). The sales of books and magazines are at all-time highs and are growing, as are sales of academic journals (Leslie, 1994). There are also many indications that more people use more reading and writing in their work and leisure than ever before and that the rates are rising despite television (Newman, 1991), the "inadequate" schools, and the breakdown of the social order. Publishers of e-books are trying to figure out why they have not lived up to expectations.

The idea of "crisis" has been a recurring theme in writings about American education (Berliner & Biddle, 1996). This dismal view is conveyed by commentators across the political spectrum and persists whether economic times are good or bad. However, major long-term measures indicate gradual improvement in schooling generation by generation, across genders, and across major ethnic and racial categories (cf., Anderson, 1988). For example, high school graduation rates in the United States at the turn of the 20th century were around 6-8%; by the 1920s they had reached 17-29%; and by the 1940s had climbed to 51-59%. For the last 25 years they have remained steady at or above 80%, and at 88% for young adults (ages 25-29). These are now among the highest graduation rates in the world (Marable, 1993; U.S. Census Bureau, 2000; White, 1987). College completion rates are now around 29% for young women and men (ages 25-29), the highest anywhere (U. S. Census Bureau, 2000). Achievement test scores, IQ scores, and other achievement

measures also show steady, long-term improvement for every group (Berliner & Biddle, 1996).

Nearly all large-scale measures indicate that the level of literacy is higher than ever before. More people spend more time reading and writing. Even in de-skilled jobs, reading and writing are now assumed components of normal workplace abilities. As we look to the future, indications are that writing will become even more a part of ordinary life. Whatever else new technologies have done, it is difficult to make the case that they diminish literate practices or fully replace old forms of meaning-making with new ones. Instead, as they are assimilated they simply enrich a growing matrix of multiple genres and media.

How Can We Assess Change?

Literacy is implicated in all human activity, and as such, is a process of language, culture, economics, politics, history, and education. It is a set of social practices through which readers and writers make meaning together, but whether we think of writing with a word processor, chalk on a slate board, quill pen, crayon, or stylus on clay, the act of writing is a material act, one that is embodied in time and place. It involves technologies, both tangible devices and sets of practices that serve as tools for the literate person. New technologies are thus neither determinate nor irrelevant to the changes in literacy. If we are to make sense of changes in literacy, we need to develop better ways of conceptualizing technologies in relation to epistemological and social processes. Such a conception helps us move beyond the new/not-new, good/bad, and tool/media dichotomies that characterize the current discourse around new technologies.

These considerations suggest a four-part framework for assessing the new literacies. This framework calls for viewing literacy as a material activity, identifying realizations in practice, understanding technologies as representations of knowledge, and seeing how technological literacy is part of social literacy.

Literacy as a Material Activity

As I write, I see words appear instantly on a screen in front of me, silently – except for the click of the keys and hum of the fan cooling the computer underneath. More than usual, I am aware of the room, the furniture, my body, the artifacts, and the tools that define the material setting of my act of writing. These things do not determine what I write, but they participate in the act; they are part of what it means to me to write and in many subtle ways they undoubtedly shape the content.

Important though it may be, the physicality of writing, as revealed through the objects in the room around me, is by no means an independent force. The very fact that I have a computer to use derives from holding a particular kind of job in a society with a capitalist economic system that supports higher education. My position cannot be separated from my history, including all the circumstances of gender, race, and class that permit me to lead the life I do. Similarly, I write in a language that for a variety of economic and political reasons is rapidly becoming the lingua franca of the world. Thus, I know my writing has at least the chance of being noticed, without the requirement of first being translated into English.

I know that what I write cannot be extracted from a complex matrix of language, economics, social relations, technologies, and embodiment situated in activities and his-

tories. I begin to see that the immediate materiality of my writing must be construed within a larger conception of its sociohistorical circumstances. If we are to understand the future of literacy, we need to see its physical manifestations as well as its social significance over time. This raises important questions: What is the sociohistorical moment at which we examine writing?

Writing was present when the first teacher encountered the first student. The student's questions led to pointing, gestures, marks in the sand, arrangements of sticks, and other ways of representing meaning, perhaps long before speech. And viewed in the context of today's multimedia representation systems, speech itself begins to look like simply another writing system. Writing is thus the first educational technology, and the many tools and forms of writing define a series of educational technologies:

Early communities with primitive symbol systems
=> complex oral language
=> early writing/inscribing
=> manuscripts
=> printing, typewriting
=> video
=> word processing, email, groupware
=> digital/multimedia/hypertext; the web
=> interactive systems, virtual reality

Figure 1. Stages in the development of writing technologies (adapted from Bruce, 1998).

These transformations gloss over many intermediate stages and side branches, but they are enough to suggest a pattern of relations between writing and its technologies. Each transformation offers at first merely new ways of doing old things. For example, mechanical printing was faster than writing by hand, especially if one desired multiple copies. After that initial substitution stage, there is an enlargement of what people can do, and ultimately a reconfiguration of the social meaning and practices, not just their physical realization (Contractor, & Seibold, 1993). There is room for debate about the direction and mechanism of the causalities, but the spread of printing certainly had implications in the West for the move toward widespread literacy, the growth of a merchant class, European imperialism, the Protestant Reformation, and other great social changes. The recent digital technologies are notable in that they not only portend similar changes, but that the linear process implied in the figure is clearly inadequate to account for the explosion of developments in diverse directions.

Realizations in Practice

One clear result of research on new forms of reading and writing has been to show clearly how technologies rarely produce simple, one-step changes. Instead, changes occur over long periods, as people develop enlarged understandings of what the technologies can do and how they enable new ways of relating to one another (Bruce & Easley, 2000). In her decade-long study of businesses struggling through the changes necessary for automating either production or office systems processes, Zuboff (1988) found changes in working conditions to be of historical significance; but people required time to

integrate the new tools into their existing practices. As they integrated the new tools, their practices changed, which in turn made other new tools relevant in ways they had not been before.

A related result is that the realizations of a technologically-based innovation vary widely (Bruce & Rubin, 1993). In a classroom, these depend on the teachers' goals, students' previous experiences with technologies, the available support, and the school's policies with respect to assessment and curriculum. One teacher may use a word processor to create practice lessons on punctuation while another may develop a year-long theme study that relies on extensive student writing and revision for publication. These differences reveal that the teacher's creative role is vital to the successful use of new technologies. As A. Luke (this volume) shows, change depends on participants at all levels within the educational system coming "to grips with new cultures, identities, and technologies."

Technologies as Knowledge

Larry Hickman (1990) makes two remarkable claims about John Dewey's theory of technology. One is that Dewey's pragmatic technology is the most productive account of how technologies are developed and used, and how they operate within social systems. The second is that his theory of technology is a key to understanding Dewey's whole enterprise. Simply put, technology is characterized as the means for resolving a problematic situation. The method devised to solve one problem becomes knowledge that prepares us for enlarged experiences later.

For example, if we need to provide structure for student learning and we devise a curriculum unit in the course of solving that problem, then that unit we construct is a technology, and the concept of a curriculum unit is a technology that we may now use in future situations. A technology can thus be conceived as the thing we get when we engage with a present situation and "extract...the full meaning of each present experience" (Dewey, 1938, p. 49). As communities develop through shared literacies, they construct technologies that reflect their collective extraction of meaning from experience. Thus, community technologies are not only a means to enable or foster literacy, but the product of a community's literacy practices.

As individuals or communities construct new technologies, they too change. According to this view, adoption of new tools is always a constructive process. The technology represents an understanding of how a need within the community can be addressed. Because it is an understanding, and not an inert artifact, the technology does not merely mediate changes in practices, but also catalyzes changes in social interactions, values, and power relations. As Zuboff (1988) found, it was not simply that new processes were adopted, but that in order to make new technologies succeed, organizations had to change as well, often in major ways:

> The material alterations in their means of production were [transforming their] assumptions about knowledge and power, their beliefs about work and the meaning they derived from it, the content and rhythm of their social exchanges, and the ordinary mental and physical disciplines to which they accommodated in their daily lives. (p. xiii)

This is another reason why Saffo's long-term changes are unexpected. It is not merely that "our disappointment" with "unfulfilled expectations" leads us to underestimate long-term effects, but that we fail to see how we will change. We are quite good at measuring the speed, size, or power of a new tool, but we have trouble conceiving that we could become something other that what we are today. We cannot easily accept that the meaning of our work, the nature of our knowledge, the "content and rhythm of [our] social exchanges," the power relations in our communities, our language, or the way that we live our lives could be much different from what they are now.

Social Literacy

The term new literacies has been used to refer to various hyphenated literacies: information-, media- Internet-, visual-, computer-, consumer-, and scientific-, to name just a few. They all relate to new means for representing knowledge and communicating. These terms usually imply access, as well as the acquisition of appropriate skills and knowledge (Bruce & Hogan, 1998; Nardi & O'Day, 1999). As members of diverse communities using these technologies, we must also develop our social literacy (Bishop, in press; Bishop, Bazzell, Mehra, & Smith, 2001), including learning how to read each other and how to grant respect and validity to diverse funds of knowledge and social capital (Smith, 1989). We need new social content in the form of artifacts and structures both online and offline that embody constructive social change. As Dewey (1966) shows, the path of individual development is inseparable from the processes of societal growth and change.

The richness of the new technologies, the access to vast resources on the world wide web, new media, and interactivity can sometimes lead to a focus on procedures over critique, thus exemplifying the split between computer literacy and media literacy discussed by C. Luke (this volume). This can lead to emphasizing content or methods in teaching, with less attention to individual learners. When we design a web site we think of its wonderful graphics or how much information it contains. Slowly, our focus shifts from the student to the materials. The teacher-centered classroom begins to dominate. Students, too, risk alienation rather than connection. Being guided by technology alone, we engage in what the French philosopher and social critic Jacques Ellul (1973, 1980) calls La Technique, the modern drive to organize living in terms of procedures that operate with mechanical precision to the exclusion of deeper human values. In essence it means elevating procedures over people, machines over humanity.

Research Questions

Literacy is embedded within a complex matrix of language, economics, social relations, technologies, and physicality. If this is so, and if these relations are multifaceted, interactive, dynamic, and even contradictory, then how do we conduct useful research that will lead to greater understandings of the processes of writing or the teaching of writing? Can we generate specific, meaningful findings that respect the complexities and the dynamics of change? Some key questions are these:

In what ways will we think about literacy differently when our potential audience has immediacy and global reach?

To what extent will the writing of students in schools around the world exhibit the global popular culture, as opposed to historically-defined local cultures?

In what ways will our concepts of published writing change through electronic media, and how will those changes in turn affect what we expect of students in school?

What will be the languages for writing in the next generation?

Can we develop a framework for studying literacy that recognizes its material conditions without reducing it to a technocentric account?

Is multimedia a mode or extension of writing as we currently conceive it? To the extent that this is so, how does that change the way we should teach writing?

How will our notions of collaboration, ownership, and plagiarism change as new tools make the finding, sharing, and intermingling of texts and writers so much easier?

How will new modes of gathering information, reading, and writing relate to the existing educational disparities along lines of race, class, nationality, language, gender, and physical ability? Will the new media lead to a blurring of these lines of social conflict, or will they heighten them as never before?

What really happens in the classroom when new approaches to literacy are introduced? How do students perceive their reading, their writing, and themselves in relation to new media?

What do teachers need to know to cope with all these changes and to support literacy development in the new century?

Questions such as these position both literacy and literacy education within a matrix of historical, institutional, cultural, social, and technological relations. They remind us that literacy is not just a procedural act, but a way of being in the world.

Conclusion

Simply using computers or connecting to the network does not ensure that teaching is easier and more effective or that adolescents will be automatically well prepared to read, write, and live in the 21st century. Instead, making good use of new technologies increases the demands on teachers, at least initially. Educators face major challenges to use these technologies to expand the possibilities for learning.

Recognizing the importance of new technologies for future writing, and knowing about the good effects they can have, many people feel that there is no question about the desirability of the world wide web, electronic mail, CD-ROMs, and other new technologies, but only about their availability. Most Americans would willingly pay higher taxes to meet school technology needs and nearly all think that well-equipped schools have major advantages in information access and in preparing adolescents for the workplace. Some go so far as to equate good teaching with the use of new technologies, implying that the presence of computers in the classroom means the teacher in that classroom is up to date, innovative, and successful. Unfortunately, new technologies are no panacea for problems in education and by themselves they at most enable, rather than create, change. It is ironic that the research showing how powerful computers can be ultimately brings us back to the familiar idea that it is teachers who make the difference (Cuban, 1993; Goodlad, 1990; Jackson, 1986).

The present conditions also call for an expanded view of learning, one attendant to diversity and critical social engagement (Dewey, 1956; Mitchell, 1961). Adolescents need to learn how to integrate knowledge from multiple sources, including music, video, online databases, and other media. They need to think critically about information that can be found nearly instantaneously throughout the world. They need to participate in the kinds of collaboration that new communication and information technologies enable, but also increasingly demand. Considerations of globalization lead us towards the importance of understanding the perspective of others, developing an historical grounding, and seeing the interconnectedness of economic and ecological systems. Rather than learning to solve well-structured problems of the kind seen in textbooks, there is a need to know how to engage with a complex situation and turn it into a problem that can be solved; thus, to find problems rather than just to solve them. Learning how to learn becomes ever more relevant in a rapidly changing technological and cultural environment. These soft skills (Murnane & Levy, 1996) are increasingly important in today's Internet world.

The reality for adolescents is that they already live within the technologized world that the advertisers promise us and Ellul warns us about. Our task is not to prepare them to be components of the global machine, nor to shrink from it, but rather to help them engage that world as informed participants and critics. Beyond any specific imperatives, the new literacies highlight the central role that language and cultural values have always had in education. Thus, as we move into the fast-paced, multimedia, internationalized 21st century, the needs in literacy education direct us to earlier conceptions of learning grounded in ordinary experience and social concerns.

Notes

1. Unfortunately, that link no longer works. As any user of the web soon discovers, the half life of web links is very short, perhaps less than a year. Contrary to some initial hopes, it now appears that it is a greater challenge to preserve digital documents than to preserve those written on paper or clay.