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A Literacy Approach to the Digital Divide

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The “digital divide” is one of the most discussed social phenomena of our era. It is also one of the most unclear and confusing. What after all is the digital divide? An income gap refers to unequal income. An employment gap refers to unequal employment. What does a digital divide refer to?

In this paper I analyze the definition of the digital divide, and compare it to prior notions of a literacy divide. I then examine the nature literacy and education in the electronic era and discuss their relationship to overcoming a digital divide.

Defining the Digital Divide

The name digital divide can in fact refer to several different phenomena. One, for example, is unequal Internet access and usage. A second is unequal ability to make use of the Internet, due not only to unequal access but also to other factors (such as education, language, content, etc.) While the second definition is preferable to the first, it is still somewhat vague—make use of the Internet toward what ends? I prefer a wider definition: the digital divide refers to *social stratification due to unequal ability to access, adapt, and create knowledge via use of information and communication technologies (ICT)*.

Let us parse these pieces a bit. First, the term “stratification” indicates that the “divide” is not really a binary division at all, but rather a continuum based on different degrees of access to information technology (see discussion in Cisler,

2000) Compare, for example, a professor at UCLA with a high-speed “Internet II” connection in her office, a student in Seoul who uses a cyber-cafe, and a rural activist in Indonesia who has no computer or phone line but whose colleagues in her NGO download information for her. The notion of a binary divide is thus inaccurate and can be patronizing, as it fails to value the social resources that diverse groups bring to the table. For example, in the United States, African-Americans are often portrayed as being on the wrong end of a digital divide (e.g., Walton, 1999), when in fact Internet access among Blacks and other minorities varies tremendously by income group with divisions between Blacks and whites decreasing as income increases (see figure 1, National Telecommunications and Information Administration, 1999).

Second, the adjective “social” is a welcome correction to the somewhat confusing term “digital.” The stratification that does exist regarding access to online information has very little to do with the Internet per se, but has everything to do with political, economic, institutional, cultural, and linguistic contexts which shape the meaning of the Internet in people’s lives. The notion of a digital divide suggests that the divide can be breached by giving someone an Internet address and email account. However, little data exists to support this. In fact, it is safe to predict that within one to two decades, Internet access will be ubiquitous in some countries, such as United States, connecting not only computers but also televisions, game machines, and mobile phones. Yet just as the ubiquitous presence of other media, such as television and radio, has done nothing to overcome inequality, there is little reason to believe that the mere presence of the Internet will have a better result. If anything, recent economic trends suggest otherwise (Castells, 1996).

The rest of the above definition thus makes clear that what is at stake is not access to information technology in the narrow sense (of having a computer on the

promises) but in a much wider sense of being able to make use of information technology for productive ends.

Models of Social Access

How then is a digital divide to be overcome? To understand this question, it is necessary to examine models of social access to particular technologies.

Devices

The simplest, but least helpful way, to think about ICT access is as access to a *device* (in this case, a computer). Access to a computing device is clearly part of ICT access, but obviously does not in itself constitute access, especially because the device itself, even if used properly, does not allow computer-mediated communication without some kind of connection to the Internet.

The one reason that the device model is appealing to some is because diffusion of devices is comparatively easy and quick, compared to diffusion of conduits, content, and practices. This is because devices are based on a one-time purchase, rather than a monthly fee (let alone the development of a skill), and the purchase price is often reduced through the availability of a wide variety of models sold both both first and second-hand. In the United States, for example, television and radio both reached 95% saturation points within approximately twenty years, and their penetration rate in low-income communities and high-income communities is approximately equal (currently at 97+%).

The cost of personal computers is falling rapidly enough that, in the wealthier industrialized countries, price alone will not likely be a major obstacle to entry-level computing. However, other issues such as differential access to human and social capital will continue to play a role in fostering digital inequality.

Conduits

Whereas access to a device implies a one-time purchase price, access to a conduit implies connection to a supply line that provides something on a regular basis. In one sense, televisions and radios are also conduit services, in that the device itself is worthless without the accompanying airwaves. However, since television and radio programming is often provided for free, and the consumer needs no special infrastructure or monthly fee to receive this free programming, the device model still holds.

Examples of conduits are electricity, telephone service, and cable television. Diffusion of conduits is generally slower than of devices, either because a delivery infrastructure must be established or because the cost of a regular monthly fee is a disincentive toward access.

Among conduits, electricity is a useful example to consider in more detail, since electricity, like ICT, has been the key to an industrial revolution. Electrification has followed a variety of paths around the world based in large part on the constellation of class forces engaged in struggle on the issue in particular countries. In South Africa, for example, wealthy industrialists developed their electrical system primarily to improve diamond, coal, and gold mining, but they did not electrify the nearby homes of their black workers (Renfrew, 1984). In the Soviet Union, Lenin launched a massive national electrification effort soon after the Russian revolution under the slogan of "Communism=Soviet Power + Electrification of the Whole Country" (Abamedia, 1999; Nye, 1990). The campaign was largely successful, and the diffusion of electricity and power plants throughout the country was a prerequisite to the Soviet Union's rapid industrialization and eventual military success against Nazi Germany. At the same time, the highly- centralized and forceful nature

of the electrification campaign, as with other aspects of Soviet industrialization, took a heavy toll on the work force and citizenry.

Between these two extremes lie the experiences of Western Europe and the United States, which used different combinations of market and governmental forces to extend universal access to electricity. In the industrialized nations of Europe, strong workers' and farmers' parties pushed for electrification to be viewed as a social service, rather than a private commodity. The state usually owned public utilities and developed electrification policies within the context of the welfare state. As a result, in Germany, Holland, and Scandinavia, 90% of all private homes—and fully 2/3 of all farmers' homes, had access to electricity by 1930 (Nye, 1990). And electrical transportation systems, such as trolleys, were operated by the government at a loss. In the US, though, with its weaker labor and farmer movements and its laissez-faire style of capitalism, electric utilities came primarily under private ownership, with the government's role reduced to regulation (Brown, 1980). By 1932, public power produced only 5% of US electricity (Nye, 1990). Unprofitable electric trolley systems in the US collapsed and were replaced by privately-owned automobiles. As a result of private ownership and the profit motive, American home electrification began "as a form of conspicuous consumption for the very rich, and only spread beyond the wealthiest classes at a slow pace" (Nye, 1990, p. 140). By the end of the 1920s, 90% of US farmers could not get electricity in their homes, and those who did often had to pay twice the urban rate (Nye, 1990). In the end, government intervention via Franklin Delano Roosevelt's 1935 Rural Electrification Act was necessary to complete the task of electrifying America. A component of Roosevelt's New Deal, the REA actually had its roots in decades of popular struggle for rural electrification (Brown, 1980).

The lesson of this for the digital divide is not that the ICT industry needs to be government-owned; indeed, privatization, done well, can be an important component of extending telecommunications (and thus Internet) access. The lesson is rather that the diffusion of any technology is a site of struggle, with policy and access reflecting broader issues of political, social, and economic power.

The comparison with electrification is of interest, especially because, similarly to ICT, electricity opened the door to a new stage of industrial capitalism. However, beyond that, the comparison begins to fade. Access to electricity is generally provided through a one-time infrastructure commitment, with relatively minor continuous payments required by users and with differences of knowledge, skills, and content irrelevant to whether people can make use of electricity.

A closer comparison can perhaps be seen in the area of telephone service, which, like ICT, makes available an important means of public communication. Access to telephone services involves issues both of infrastructure (e.g., telephone lines, satellites, cellular antennae) and affordance of ongoing costs. Governments have sought to promote mass access to telephony for a number of reasons. First, similarly to ICT, telephone (in)access has been viewed as a factor which can compound or overcome other disadvantages related to poverty, unemployment, and access to goods and services (Graham, Cornford, & Simon, 1996). In addition, in developed countries, where telephone access has reached over 90%, lack of telephone access is seen by some as an inhibition of people's opportunity to participate in societally recognized civil and social discourse (Preston & Flynn, 2000). Finally, it has been recognized that, universal telephone service, like universal electrification, could not be provided by market forces alone, since it involved laying expensive lines

to rural areas that might have a small number of users (at least before the advent of wireless telephony).

Beyond the individual benefits of telephone services, governments have also promoted expanded telephone access for reasons of collective welfare. In today's world, telephony is a key component of development, and developing countries recognize that poor and limited telephone service restricts opportunities for foreign investment and economic modernization. In addition, even in countries where many are already connected, there is a network effect to telephony; a telephone network, like a fax network, or the Internet, gains value when more users are connected to it. (Think of the converse; the only telephone or fax machine in the world is valueless, because there is no one else to communicate with.) Therefore, each added user is seen as benefiting not only that user but the entire network and society.

Practices

Though conduits provide a better comparative model than devices, neither one captures the essence of access to information and communication technologies. What is most important about ICTs is not so much the availability of the computing device or the Internet line, but rather people's ability to make use of that device and line to engage in meaningful social practices, specifically to communicate with people, to access information, and to publish information. Those who are illiterate, who have never learned to use a computer, and who do not know major languages will have difficulty even getting online much less using the Internet productively, at least with the types of computers, Internet connections, and online content currently available.

Lievrouw (2000) discusses this issue and suggests the notion of *content* in opposition to that of *conduit*. According to her view, content encapsulates the physical access to the device and information channel, and two additional elements:

(a) institutional sources of information, and (b) sufficient individual capacity to make use of that information to engage in social action and discourse. Though I agree with Lievrouw's notion, I will set avoid the word content since it usually refers to the first of the preceding two elements, rather than the two of them combined. Another possible term is *skill*, though I will avoid that as well since it usually refers to the second of the two elements (rather than to both of them), and for additional reasons I will explain below.

Literacy

The word "practices" instead suggests the way that users are able to combine device, content and skill to be able to engage in activities. The best previous example of access to practices is that of *literacy*. There are many similarities between literacy and ICT access (see figure __). First, both literacy and ICT access are closely connected to advances in human communication and the means of production of knowledge. Second, just as ICT access is a prerequisite for full participation in the informational stage of capitalism, literacy was (and remains) a prerequisite for full participation in the earlier industrial stages of capitalism. Third, both literacy and ICT access necessitates a connection to a physical artifact, to sources of information that get expressed as content within or via that physical artifact, and to a skill level sufficient to process and make use of that information. Fourth, both involve not only receiving information but also producing it. Finally, they are both tied to somewhat controversial notions of societal divides: the *great literacy divide* and the *digital divide*.

Because of the similarities between ICT access and literacy, it is worth exploring more in depth what literacy is, how it develops, and what research has shown regarding the existence of a literacy divide.

While the common sense definition of literacy is the individual skill of being able to read and write, literacy theorists prefer a broader definition that takes into account the social contexts of literacy. What they point out is that what is considered skillful reading or writing varies tremendously across historical and sociocultural contexts (Gee, 1996). For example, in the pre-Gutenberg era, writing principally involved memorizing and transcribing oral speech or carefully and accurately copying classical manuscripts (McLuhan, 1962). A skilled writer thus had outstanding mnemonic and penmanship abilities. Reading was often done publicly, with an orator slowly reading a manuscript out loud. Whether done publicly or privately, though, the purpose of reading was to interpret a small number of classical and religious texts in order to achieve "a new consciousness of what a text *could have meant* or *could mean* to a putative reader" (Olson, 1994, p. 157, emphasis in original).

These notions of reading and writing started to change as early as the 12th century (Olson, 1994 #1637, but changed much more rapidly following the introduction of the printing press in the mid-15th century. In the new print era, scholarly writing came to be viewed as authorship of original material, and scholarly reading came to mean the gathering, comprehending, and making use of information from a variety of sources (Eisenstein, 1979a; 1979b)

Notions of literacy have continued to change in the last 100 years. For example, De Castell and Luke (1986) identify three distinct paradigms of school-based literacy in recent U.S. history, each highly dependent on the social, economic, and cultural norms of particular epochs. In the 19th century classical period, literacy was viewed as knowledge of literature and attention to rhetorical appropriateness. Literacy pedagogy involved rote learning, oral recitation, copying, and imitation of "correct speech and writing." And the literacy curriculum was based on exemplary

texts such as the Bible, a narrow selection from Greek and Roman literature, and handwriting primers. This paradigm corresponded to the needs of an aristocratic social structure, in which, land, power, and knowledge was concentrated in few hands, and education involved obedience to tradition and power.

Following the mass industrialization of the early 20th century, a Deweyan progressive paradigm of literacy emerged as a "self-conscious attempt...to provide the skills, knowledge, and social attitudes required for urbanized commercial and industrial society" (de Castell & Luke, 1986, p. 103). In this paradigm, literacy was viewed as a form of self-expression. Literacy pedagogy involved teacher/pupil interaction and the "discovery method." The literacy curriculum included civics, adventure stories, and self-generated texts.

But the progressive model never fully took hold; rather it was in constant struggle with a more technocratic paradigm which eventually won out (Cuban, 1993). In this technocratic paradigm, literacy was viewed as the "survival skills" necessary to function in society. Literacy pedagogy involved programmed instruction, learning "packages" with teacher as facilitator, and "mastery learning" of a common set of objectives. And the literacy curriculum was based on decontextualized subskills of literate competence.

From this brief historical sketch, we can conclude that literacy is not a context-free value-neutral skill; rather, being literate "has always referred to having mastery over the processes by means of which culturally significant information is coded" (de Castell & Luke, 1986, p. 374). Because there are different types of literacy—not only across time but also within the same society (basic literacy, academic literacy, etc.) , the plural form "literacies" is often used by literacy theorists. In the same vein, literacy theorists often prefer to use the term "literacy practices"

rather than "literacy skills," as the former term emphasizes the importance of actual application of literacy in social context.

A Literacy Divide?

One of the most significant theoretical questions related to literacy, and one that corresponds closely to current debates over a digital divide, is whether there exists a great "literacy divide." Literacy continues to be available on a highly unequal basis. Adult literacy rates range from over 99% in some of the most developed countries (including Italy, Spain, Israel, Singapore, Greece, and South Korea), to the 50-60% range in some developing countries (e.g., 55.7% in India, 53.7% in Egypt), to under 30% in some of the poorest countries (e.g., 22.2% in Burkina Faso, 14.7% in Niger, United Nations Development Programme, 2000). Literacy is highly correlated with income and wealth at both an individual and a societal level. So, in one sense, the importance of literacy to social and individual development is almost undisputed.

Yet there are some who go beyond this general claim about the benefits of literacy to assert that there are fundamental cognitive differences in individuals who are literate and who are not, resulting in a great literacy divide at both the individual and societal levels. Literacy is said to separate prehistory from history (Goody & Watt, 1963), primitive societies from civilized societies (Levi Strauss, in Charbonnier, 1973), and modern societies from traditional societies (Lerner, 1958; see discussion in Scribner & Cole, 1981). At the individual level, literacy is said to allow people to master the logical functions of language (Goody, 1968; Olson, 1977) and to think abstractly (Greenfield, 1972; Luria, 1976).

The impugned cognitive benefits of literacy have proven very difficult for researchers to investigate. The problem is that literacy is almost always confounded with other variables, and, particularly, with schooling. For the most part, those who

are completely illiterate have had little or no schooling, whereas those with high levels of literacy have had a good deal of schooling. The covariance of literacy with other social factors has made the cognitive impact of literacy a thorny question to attack.

Two American educational psychologists, Sylvia Scribner and Michael Cole, eventually found a very creative way around this obstacle. They identified a tribe in Liberia, called the Vai, who had developed their own script in their own local language. Literacy in the Vai script was passed on through informal tutoring, not through schooling. And Vai literacy was used in very limited ways, especially for personal correspondence and business records. By carrying out a three-way study that compared illiterate tribal members, those literate only in the Vai language (through personal tutoring), and those with English or Arabic literacy skills gained through secular or religious schooling, Scribner and Cole (1981) were able to separate which cognitive benefits were gained from literacy and which others were due to the broader environment of schooling.

Interestingly, Scribner and Cole found virtually no generalizable cognitive benefits from Vai literacy. Individual differences on a range of cognitive tasks, in areas such as abstraction, classification, memory, and logic, were instead due to other factors, such as schooling, or, in some cases, living in an urban (as opposed to rural) area. Vai literacy was found to be correlated with better achievement, as compared to non-literates, in functional tasks that were related to the practices of Vai literacy. These included giving grammatical explanations, picture reading (i.e., decoding graphics according to a pre-assigned code), and picture writing. Similarly, the cognitive benefits of Arabic literacy were closely associated with the functions of its use. The main benefit of Arabic literacy was in the area of verbal recall, which is not

surprising since Arabic literacy is developed in Liberia through memorization of the Koran. More complex and generalizable cognitive tasks, such as solving abstract logic problems, were correlated only with schooling and English literacy, which is again, not surprising, given the types of abstraction and problem-solving which are practiced in school. And on no single task in their entire study did every Vai literate outperform every non-literate (in other words, individual variation trumped group variation according to literacy level.)

Scribner and Cole's study helped settle the question whether or not there is a great literacy divide, at least at the individual level. Their work showed that there is no single construct of literacy, that divides people into two cognitive camps. Rather there are gradations and types of literacies, with a range of benefits closely related to the specific functions of literacy practices.

Acquisition of Literacy

Finally, there is the issue of acquisition of literacy. Once literacy is understood as a social practice that involves a range of skills, knowledgs, and resources, it is also easier to understand the social basis of literacy learning. Brian Street (1984; 1993) and other critical literacy theorists (e.g., Cope & Kalantszis, 1993; Freire, 1970; Lankshear, 1994) have shown how access to literacy is closely tied to issues of social, political, and economic power. From South Africa to Brazil to the impoverished ghettos of the United States, access to literacy intersects with unequal opportunities to attend school, inequitable distribution of resources within the educational system, and curricula and pedagogy that meet the needs of certain groups more than others. Because of this situation, in many cases literacy is not so much granted from above, but rather seized from below through the social mobilization and collective action of the poor and dispossessed.

Literacy and ICT Access

Putting the contribution of prominent literacy theorists together, we arrive at five major conclusions about literacy:

- There is not just one, but many types of literacy
- The meaning and value of literacy varies in particular social contexts
- Literacy exists in gradations, rather than in a bipolar opposition
- Literacy alone brings no automatic benefit outside of its particular functions
- Acquisition of literacy is a matter not only of education and culture, but also of power

These points can also serve as the basis for a theory of the digital divide and ICT access: There is not one type of ICT access, but many; the meaning and value of access varies in particular social context; access exists in gradations, rather than in a bipolar opposition; computer and Internet access alone brings no automatic benefit outside of their particular functions; and acquisition of ICT access is a matter not only of education and culture, but also of power.

The development of a more sophisticated understanding of literacy did not lead to a downplaying of its importance – far from it. Actually, by better understanding literacy, academics, educators, and policy-makers could better promote it. By better understanding ICT access, we can also better promote it and thus help overcome social exclusion.

ICT access involves a complex array of physical resources (e.g., computers and connectivity), digital resources (e.g., content and language), human resources (e.g., literacy and education), and social resources (e.g., community and institutions; further discussion Elsewhere I have discussed all of these at length (Warschauer,

2003). In this paper, I will now specifically on issues related to literacy and education.

Electronic Literacies

New types of computer- and Internet-based literacy practices are emerging that I have referred to *electronic literacies* (Shetzer & Warschauer, 2000; Warschauer, 1999). Electronic literacies are not isolated from the types of literacy practiced with print, but rather involve added layers that account for the new possibilities presented in the electronic medium (Buzato, 2001; Selfe, 1990). Electronic literacy is actually an umbrella term that encompasses several other generic literacies of the information era that I will address below. First, it is necessary to comment briefly on the more general relationship between technological tools and literacy.

Technology and Literacy

All human activity is mediated by tools. What is significant about tools is not their own abstract properties but rather how they are incorporated into, and fundamentally alter, human activity. In other words, tools do not simply facilitate action that could have occurred without them, but rather, by being included in the process of behavior, alter the entire flow and structure of mental functions (Vygotsky, 1981). The integration of tool, mental system, and human activity is illustrated nicely in Bateson's (1972): discussion of the blind man with a stick:

Suppose I am a blind man, and I use a stick. I go tap, tap, tap. Where do I start. Is my mental system bounded at the handle of the stick? Is it bounded by my skin? Does it start halfway up the stick? Does it start at the tip of the stick? But these are nonsense questions. The stick is a pathway along which transformations of difference are being transmitted. The way to delineate the

system is to draw the limiting line in such a way that you do not cut any of these pathways in ways which leave things inexplicable. If what you are trying to explain is a given piece of behavior, such as the locomotion of the blind man, then, for this purpose, you will need the street, the stick, the man (p. 459).

The tools of literacy include language itself as well as a wide variety of physical artifacts, such as the papyrus, codex, book, pencil, pen, paper, or typewriter. The development of each of these tools has had a profound effect on the practice of literacy. Today, social, economic, and technological transformations are again aligned to bring about major changes in literacy practices. The resultant electronic literacies include *computer literacy*, *information literacy*, *multimedia literacy*, and *CMC literacy*.

Computer Literacy

The term computer literacy first emerged in the early 1980s soon after the popularization of the personal computer¹. Within a decade, the term had become widely discredited among educators, because it had generally been used to refer to only the most basic forms of computer operation, such as turning on a computer, opening a folder, and saving a file. And, unfortunately, too much of computer-related education, even today, is narrowly focused on these basic types of computer literacy.

While the criticisms of computer literacy as an end in itself are certainly merited, this justified critique should not persuade us to give short shrift to the underlying concept. There does exist an ease (or, alternately, unfamiliarity and discomfort) with the physical and operational manipulation of a computer that profoundly affects people's productivity with it. The author Gabriel García Márquez, among others, has described how his own productivity as an author has

multiplied greatly through his writing on computer, which in a novelist's case need not entail much more than use of word processing software and manipulation of the mouse and keyboard. But in the case of Garcia Marquez—a perfectionist who would previously copy and recopy a page to correct a typing error—even basic computer literacy greatly increased the speed with which he could write, and thus his literacy output. It also allowed him to transform his method of writing, which earlier involved perfecting one page a day but now involves working on longer sections in an integrated manner (Day & Miller, 1990). Did the computer make García Márquez a better writer? Perhaps it is as difficult—and meaningless—to answer that as to answer whether the stick made the blind man smarter. Let us just say that the activity of *García Márquez+computer+writing* is a different activity than *García Márquez+typewriter+writing*, involving a different process of writing as well as a higher output.

Information Literacy

The value of information literacy stems not just from the development of the computer and the Internet, but also from the development of the broader information society. The difficulty, and importance, of managing the rapidly-expanding amount of information of the modern era was recognized by Vannevar Bush more than half a century ago, who proposed a hyperlinked database using microfilm (called a Memex, see Bush, 1945). Bush's dream was eventually realized in a format he never imagined with the creation of the World Wide Web in the 1990s. The development of the World Wide Web, together with a host of other public and commercial online data bases, allowed unprecedented personal access to information around the world—but only to those with the appropriate information literacies.

Some of the skills involved in using ICT to locate, evaluate, and use information include being able to:

- Develop research questions
- Determine the most likely places to seek information
- Select the correct search tool
- Formulate appropriate search queries
- Rapidly evaluate the result of a search query, including the reliability, authorship, and currency of a source
- Save and archive located information
- Cite or refer to located information (see further discussion of these points in Shetzer & Warschauer, 2000)

Information literacies involve both computer-specific knowledge (e.g., knowledge of browsing software and search tools) as well as broader critical literacy skills (e.g., related to analysis and evaluation of information sources). Many of these broader critical skills were of course also important in the pre-Internet era. They are not so much new skills, but they do take on added importance now. Think, for a moment, of the difference between a student research assignment in the 1970s and today. In the '70s, a student would check some books out of the school library. These books had been vetted twice: once by the publisher and once by the librarian who purchased the books. With the reliability of the book's contents thus already established, the work of the school student was thus largely limited to gathering and summarizing information from a variety of library sources.

Today, a student who relies at least in part on information from the Internet has a much greater personal responsibility to critically evaluate information sources. Indeed, it is impossible to even navigate or search the Internet without making very

rapid judgments as to the reliability of various sources of information. A reader (surfer?) must decide on the spot whether to pursue information on a particular page, follow links to other sites, or return back to a search engine for another try. In such a circumstance, it makes little sense to discuss critical literacy as a separate or special construct; rather, critical literacy is an essential element of reading in the online era.

Multimedia Literacy

In the past, literacy chiefly meant alphabetic literacy. That is because the main technologies of literacy, such as the printing press, have “privileged the written language over all other forms of semiosis,” thus separating verbal from iconographic information and representation (Kaplan, 1995, p. 15).

But human beings have a desire for what Bolter has called “the natural sign” (Bolter, 1996, p. 264). As Bolter explains, “Pictures or moving pictures seem to have a natural correspondence to what they depict. They can satisfy more effectively than prose the desire to cut through to a ‘natural’ representation that is not a representation at all” (p. 265-266). This desire for the natural, partially suppressed due to the limitations of print, but has broken out widely throughout the twentieth century, not only in the popularity of film and television, but also in recent developments in newspapers, magazines, and books. Kress (1998; 1999; 1996) illustrates nicely how both newspapers and textbooks have dramatically altered in format in recent years, with visual images becoming increasingly dominant.

It is in the realm of computers, though, that multimedia has progressed the furthest, due to the ease of combining text, backgrounds, photos, graphics, sounds, and video in a single presentation. The falling cost of computers and multimedia software means that hundreds of millions around the world have the desktop power to

create multimedia documents, ranging from a simple PowerPoint presentation to an original movie.

This re-emergence of the “natural sign” has profound implications for digital democracy. The domination of the alphabet has long had a deep impact on inequality. Learning to read and write takes years of schooling, and the gap between the schooled/literate and the unschooled/illiterate (whether at the individual, village, or societal level) has intersected with, and contributed to, all other socio-economic divides of the last millennium. Text literacy also privileges the few dozen dominant written languages of the world (many with colonial histories, such as English, Spanish, and French) at the expense of indigenous languages, fewer of which are used for reading and writing. Finally, the social practices of text literacy in schools—which often have focused on decontextualized, individual study and memorization, rather than collective creation and interpretation—have further alienated groups of people, including many tribal and indigenous groups around the world whose traditional methods of learning focus not on memorizing a page but on sharing, creating, and story-telling using audio-visual elements such as song and dance (Warschauer, 1999). For all these reasons, the rise of multimedia should provide an important opportunity to level the field of literacy, by privileging natural forms of communication that are in some ways broadly accessible.

However, in other ways, the economics of the information technology industry, together with the sociology of schooling, means that multimedia creation is highly *unaccessible* to the masses. On the one hand, while the cost of computers and Internet access continues to fall, the cost of the hardware, software, and bandwidth necessary to create the newest forms of multimedia will always be more expensive, and Becker (Becker, 2000a) has shown that stratified access to multimedia computers

in the US parallels other types of income and educational stratification . In addition, in the US and many other countries, the sociology of schooling is such that students in wealthier communities generally get more frequent opportunities to create sophisticated multimedia projects, whereby low-income students are relegated to using computers for remedial drills and exercises (Becker, 2000a; Becker, 2000b; Schofield & Davidson, 2004). As a result, the potential of multimedia as a force for social equalization can be turned into its opposite, with some sectors of the population learning how to become the producers of tomorrow's multimedia content, while others are prepared only as passive recipients (see discussion in Castells, 1996; Warschauer, 1999).

Computer-Mediated Communication Literacy

The above types of literacy have been widely noted by others. Computer-mediated communication (CMC) literacy has not received as much attention.

CMC literacy refers to the interpretation and writing skills necessary to communicate effectively via online media. At a simple level, this includes the “netiquette” of polite online communication. At a more advanced level, it includes the pragmatics of effective argumentation and persuasion in various sorts of Internet media (e-mail, Web based bulletin boards, etc.) At the most advanced level it includes ways to establish and manage online communications for the benefits of groups of people (i.e., community organizations running their own discussion or training sessions online).

Much basic CMC literacy is learned implicitly and needs no instruction; an hour or two in a chat room and a teenager will begin to pick up the style of interaction. However, it would be a mistake to infer from this that CMC literacy is in all forms developed naturally, or that CMC is not important, or even negative, since it

largely revolves around chat. CMC has become a potent form of business (American Management Association International, 1998) and academic (Agre, 1997) communication, and its more sophisticated forms are not as easy to learn. In this light, it is useful to consider the distinction made by Cummins (1984) between Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP) for immigrant students to the US. Cummins pointed out that just because immigrant children learned conversational skills in English, through informal chatting on the playground, did not negate the need for focused instruction in mastery of more cognitively challenging varieties of English, such as reading and writing academic essays. In the same ways, the fact that children know how to chat on a computer does not mean they know how to write an effective e-mail message to a business organization, academic institution, or political representative.

The importance of CMC literacy is illustrated through an example from my own research with international students in Hawai'i (Warschauer, 1999). One important international divide concerns control of research, with developed-country academics often usurping authorship rights of research partners in developing countries. In this particular example, a Chinese researcher had carried out much of the ground research in a study on community public health, and had prior agreement that a certain part of the research data would be under his control. In contrast to this agreement though, his two Swedish colleagues e-mailed him and informed him that they were going to publish the research under their own signatures. The Chinese researcher had absolutely no clue as to how to write an effective e-mail message protesting this situation, and, following forms of oral communication common in China, he wrote a draft of an e-mail which addressed the issue only in the most circular fashion, after spending a lengthy introductory paragraph discussing the health

of one of the Swedish colleague's mother. Fortunately that draft—which may have lost him his authorship rights—was never sent. After much discussion and intervention from some American colleagues, the Chinese researcher learned to rewrite the message in a much more direct and effective manner. The Swedish colleagues got the message and were persuaded to yield.

This last example illustrates how electronic literacy involves far more than being able to operate a computer. Rather, it is an act of agency: “the power to construct a representation of reality, a writing of history, and to impose reception of it by others” (Kramsch, A'Ness, & Lam, 2000). Its practice involves not only the individual activity of decoding and encoding text, but also the social activity of exercising control. Like other forms of literacy, it entails not only reading the *word*, but also reading the *world* and, in a sense, writing and re-writing the world (Freire & Macedo, 1987).

How then can these new literacies be best taught and learned among marginalized communities? How can acquisition of these literacies contribute to overcoming the so-called “digital divide”?

The Social Life of Education

How we use computers in teaching and learning flows from, and is closely related to, much broader issues of how people learn and the role of formal education in the process. Educational debate in the United States and many other countries has been dominated by two schools of thought. The first of these views *education as a transmission process*. The second of these views *education as a constructive process*. Both of these, however, downplay the social aspect of education, and it is that aspect that is particularly relevant in evaluating the potential impact of ICT on learning.

A transmission perspective views education as the acquisition of facts, information, skills, and knowledge through a regime of lecture and tutoring. It is the philosophy behind E. D. Hirsh's famous book on Cultural Literacy (1987) and his subsequent series of books on what students at each grade level should know. It is, unfortunately, the type of educational approach that is fostered by the emphasis on high-stakes multiple-choice testing. It is an approach that is clearly at odds with the imperatives of an information age, in which the memorizing of facts that our grandparents knew is much less relevant than one's ability to construct and communicate new knowledge from a wide variety of data sources.

The main challenger to the transmission view is a constructivist approach to education. Based on the ideas of Jean Piaget (1970), constructivism views learning as an internal mental process based on an individual's discovery of external phenomena. Constructivists seek to foster opportunities for exploratory learning and the development of mental models.

The theoretical opposition of the transmission and constructivist approaches colors many of the educational debates taking place in the US and other countries. A prominent example is the loud and prolonged struggle between advocates of *phonics* and *whole language* for reading instruction. Supporters of phonics see reading as emerging from the memorization of dozens of rules about how individual letters are sounded out. Whole language advocates see reading as an emergent psychological process based on children's discovery of meaning. Similar and struggles take place over issues related to spelling (shall learners' mistakes be tolerated?), writing (the following of rules or the discovery of voice), mathematics (the memorization of rules or their discovery), and science (memorization vs. experimentation).

Unfortunately, these debates tend to obscure, rather than shed light on, the actual processes by which learning takes place. In particular, both of these approaches fail to value the social factors that are at the heart of learning and education. These social factors take place at both a micro-level and a macro-level.

Micro-Level: Communities of Practice

The micro-level concerns the types of social interaction that surround the learning process. As numerous researchers have shown, learning is as much about enculturation as it is about transmission or discovery (e.g., Lave, 1988; Ochs & Shieffelin, 1984). To begin with, almost all human learning takes place in *communities of practice* (Lave & Wenger, 1991). Communities of practice are networks of people that engage in similar activities and learn from each other in the process. Sometimes those communities are found in formal learning structures, such as classes and schools. More frequently, they are based on informal networks, such as families, professional or occupational groups, or social circles.

Learning in communities principally takes place through a process of apprenticeship. This occurs at the every level from the most basic (e.g., a child learning to walk or talk) to the most advanced (e.g., a medical internship or PhD study). Some of the learning that occurs through apprenticeship is via direct instruction; much more of it (even in formal educational settings) occurs informally or incidentally, through observation, imitation, experimentation, modeling, appropriation, and feedback. An ideal learning situation provides the kind of scaffolding so that apprenticeship learning can take place in a safe, supported way.

Apprenticeship often occurs through a mentoring process with a (formal or informal) teacher or a more capable peer. Vygotsky (1978) has described this type of learning in terms of a *zone of proximal development (ZPD)*; a learner advances

through the ZPD by gradually taking on tasks alone that he or she could previously only do with assistance. However, the involvement of an expert or mentor is not a requirement for apprenticeship learning to take place. Plenty of evidence exists that informal networking among peers is a valuable source of learning, and often more valuable than direct instruction. Learning situations that provide for a good deal of informal peer networking maximize people's opportunities to learn; situations that exclude this kind of informal networking can endanger the learning process. This principle has a good deal of importance to the issue of technology that will be illustrated throughout the chapter and the book. Just to give one example, consider how relatively easy it is to learn a new computer program while working in an office or other environment where others are using it who can provide ready feedback and assistance, compared to the difficulty of learning a new computer program by oneself at home.

Why are communities of practice so important? First of all, because the most valuable learning in society involves not so much *learning about* but rather *learning how* (Brown & Duguid, 2000). An excellent example of this is seen in writing. Learning to write is not a matter of memorizing or otherwise certain facts about writing. It is a matter of engaging in the social practice of writing in the company of colleagues, peers, critics, and mentors. Learning how to write involves appropriating the language of others, modeling examples of writing that one reads, responding to questions and suggestions, and receiving and considering the guidance of expert critics, whether they be your classroom teacher, your dissertation committee, or the peer reviewers for an academic journal. Learning *about* writing might take place in a couple of days by reading a book or two alone; learning *how* to write takes many years of engagement in communities of writers.

Equally importantly, *learning how* is intimately tied up with *learning to be*, in other words developing the disposition, demeanor, outlook, and identity of the practitioners. This is obvious at the most advanced level. For example, learning how to conduct scientific research inevitably involves learning how to think, act, and interact as a research scientist. It is also true at the most basic level. For example, a study of participants at community technology centers in California found that identity formation was a critical component of learning how to use a computer (Stanley, 2001). Many that had computers at home never used them, partly out of fear and lack of knowledge but also because of their own self-concept. They simply didn't see themselves as the type of people who used computers. As one person noted,

I thought [computers] were too much to dream about; like a dream that is too far from reality. I couldn't see myself as someone who uses computers. I thought they were for smart people or college students.

Fully 70% of the interviewees in the study mentioned similar self-concept or identity issues related to computers. Only after coming to a community technology center and becoming part of a community of practitioners did they begin to change their self-image.

Macro-Level: Social Reproduction

Social context plays an important role not only the micro-level of community interaction, but also at the macro-level of how educational institutions and processes are structured. The key concept here is *social reproduction*; in other words, learning institutions are structured in ways that reflect and contribute to the broader social, economic, politic, and cultural relationships (Bowles & Gintis, 1976; Willis, 1977).

The most interesting research conducted in this regard as related to educational technology was conducted by Stanford professor, Larry Cuban. Cuban's 90-year history of educational practices (Cuban, 1993) demonstrated that US schooling is highly resistant to reform, as teachers' behaviors are constrained in numerous ways by societal norms and expectations. Meaningful reforms that do take place almost always benefit the most economically privileged students, who are deemed suitable of engaging in critical and reflecting learning. Reforms in low-socio-economic schools generally take place on the margins of the educational process and fail to seriously transform the learning process. Cuban conducted a parallel historical study that examined uses of educational technology since 1920, including radio, television, film, and the first wave of computers (1986). He found that technology was frequently imposed from outside parties—especially from self-interested technology businesses—and had little impact on reshaping education, which responded instead to broader socio-economic imperatives.

Situated Learning and Critical Pedagogy

How is a social approach to education translated into classroom practices? To accomplish this, two models of teaching and learning are required: *situated learning* and *critical pedagogy*. Situated learning has two main focuses. The first is on assisting students become part of *learning communities*. As Brown, Collins, and Duguid explain (1989) “To learn to use tools as practitioners use them, a student, like an apprentice, must enter that community and its culture. Thus in a significant way, learning is...a process of enculturation” (p. 33). The second emphasis is on providing students opportunities to “carry out meaningful tasks and solve meaningful problems in an environment that reflects their own personal interests as well as the multiple purposes to which their knowledge will be put in the future” (Collins, Brown, &

Newman, 1989. p. 487). These focuses are interrelated. For example, a high school science teacher should facilitate students entry into the community and culture of scientists by providing students similar kinds of tasks—formulating questions, gathering and analyzing data, developing interpretations—that they might later engage in as researchers.

Critical pedagogy shares much with notions of situated learning, but also emphasizes the role of learners themselves in defining their own problems based on the needs of their families and communities, and confronting these problems through collective inquiry and action as part of the educational process (Freire, 1970/1994). Learners can thus challenge the problem of social reproduction by analyzing, critiquing, and challenging unequal power structures as part of the learning process. Cummins and Sayers (1990; 1995) later adopted this approach to Internet-enhanced learning, through the formation of long-distance partnerships to identify and address important social issues as defined by learners. An example of this kind of intersection is seen through the “Strawberry Project” in a California school.

“Project Fresa”: Fostering Critical Literacy with Technology²

The strawberry project was carried out at Mar Vista Elementary School is located in the midst of strawberry plantations in Oxnard California, a couple of hours north of Los Angeles. About 80% of the students in the school are Latino (including Mexicans, Mexican Americans, and Latin Americans), and the majority have family members working as laborers in the strawberry fields. Though most schools in California have ended bilingual education following a 1998 statewide initiative, Mar Vista is one of a small number of schools that have continued bilingual programs due to a progressive administration and parental demand. Teachers at Mar Vista have also become leaders in effective use of ICT to promote critical literacy among among

traditionally marginalized students. This is accomplished through theme-based project-oriented instruction that is sensitive to students' own social concerns while at the same time is cognitively demanding.

An example of this is "Project Fresa," a theme-based year-long project for primary students. The project takes as its main focus the local strawberry industry. The children begin by formulating their own research questions about the conditions of strawberry workers. They then conduct interviews and surveys of their family members, relatives, and neighbors based on these research questions. (They often conduct the interviews in Spanish and then translate responses into English.) Afterwards, they learn to record in spread sheets and to produce graphs in various formats of the data they have gathered (analyzing, for example, which types of graphs best the information). The graphs are incorporated into PowerPoint presentations together with photos and quotations from the people they have interviewed. With the guidance of the teachers, they then search for further information about the conditions of strawberry workers on the Internet, and also have guest speakers come to their classroom from environmental and workers' rights groups. Based on the information from the Internet and speakers, they write letters via e-mail to the strawberry growers expressing any concerns they might have about strawberry workers' rights. In past years they have also sent emails to elected officials, such as the governor, with inquiries about agricultural laborers' rights. After engaging in this kind of work, they then begin an e-mail exchange with children in Puerto Rico who live in a coffee growing area to compare notes about the industry and the condition of workers. At the end of the year, they have a public presentation, in which their parents and other community members come view the multimedia products they have created.

As compared to use of the computer for drills and exercises, this kind of project-based teaching has several strengths. Students learn to actively master technology, rather than use it in a passive manner. They engage in their own research, data collection, analysis, and interpretation, and produce quality products such as letters to elected officials and data-based presentations. They also learn to speak out and take action on issues of importance to their community. Through gathering and weighing information from a variety of sources, including workers, non-governmental organizations, businesses, and politicians, they gain a better understanding of how different actors shape the strawberry industry and the conditions of its workers.

Conclusion

This example brings us full circle. Overcoming the digital divide involves much more than mere provision of a computer or an Internet account. Rather, it involves the development of new forms of critical electronic literacies encompassing active mastery of technology. These in turn are learned through active engagement in communities of practice addressing relevant social concerns.

ICT access is not found through an AOL account, but through the informed deployment of a variety of technologies in the service of collective inquiry and social action. This is the lesson of a literacy approach to understanding the digital divide.

Notes

¹ The earliest American newspaper, magazine, or journal reference found via the Lexis Nexis data base was a 1981 article in the Washington Post (Milloy, 1981).

² Information on this project and school comes from the Project Website (<http://equity4.clmer.csulb.edu/netshare/cti/%20FOR%20PSRTEC%20WEBSITE/Amada%20and%20Michelle/>) , from an interview with teachers Michelle Singer and Amada Irma H. Perez (May 2001), and from an interview with Kevin Rocab of the Center for Language Minority Education & Research in Long Beach, California (May 2001)

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