CHAPTER 5

Defining and Designing Literacy for the 21st Century

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FOCUS QUESTIONS

1. How do technological changes relate to changing definitions of literacy in the 21st century?
2. In what sense are literacies technologies?
3. What equity issues arise in the context of 21st-century literacies?
4. What kinds of literacy pedagogies are emerging in the 21st century?
5. How might literacies and literacy pedagogies be designed to promote digital equity?

What do you think of when you think of literacy? That generally depends on who you are, where you find yourself on the hierarchies of social status and privilege, the cultural spheres you participate in, and what you do day-to-day. If you were an English-speaking child you might recall singing your ABCs and reading The Cat in the Hat. Perhaps for you, literacy evokes images of reading a good novel, writing a paper, or doing either of these in a language other than English. What about filling out a job or a welfare application? Being literate might mean having the skills to create a financial spreadsheet, compose a symphony or write a computer program. It might mean carrying out a conversation in American Sign Language or writing a note to put on the refrigerator telling family members when you’ll be home and that you love them.

Literacy might be tied to the communal study of a religious text—the Bible, Torah, Koran, or Upanishads. It may involve pictographic, non-Roman, non-phonetic characters and reading up and down or right to left. Perhaps for you, it includes sending out invitations to your daughter’s quinceañera. Or it may involve reading and passing down to your children the treaties that define the formal relationship between your Indian nation and the U.S. government. In the 21st century, typing on your computer keyboard in order to chat in an online forum about your favorite television show; or, better, to participate in an online educational “virtual world,” is a digital literacy act. You might also include, in your literacy definition, watching
and making sense of the news, or any other television program, where speech, image, video, and text merge as "media." Media authoring, not merely watching or surfing, is also key to interactive multimedia environments and the World Wide Web. If you have privileged access to digital technologies and educational opportunities, literacy may involve the multimedia rendering of 3-D visualizations of molecular structures, crafted, shared, and manipulated in simulations over networked digital computers. Or, perhaps, you have opportunities to create digital videos that express your point of view and then to stream them over the Internet.

Literacy acts are diverse, personal as well as public, multicultural, multilingual, and multi-modal (involving print, books, images, video, computers, gesture, smoke signals, art, etc.); they pervade forms of communication and social participation, coordinate activities and social purposes, and occur in diverse, situated contexts (Cope & Kalantzis, 2000; Engeström, Miettinen, & Punamaki, 1999; Lankshear, with Gee, Knobel, & Searle, 1997; Lave & Wenger, 1991; Vygotsky, 1978). This may not be news. However, some of the literacy opportunities mentioned above would not have been possible for nearly all of us only 30 or so years ago, with many emerging broadly only since the mid-1990s—and are still not available to most people in the world.

How do new digital technologies relate to changing notions of literacy in the 21st century? This chapter will discuss some ways in which information and communication technologies are intimately involved in enhancements and transformations of traditional literacy, as well as how current and potential uses of digital technologies create not only new possibilities, but new requirements and, at times, obstacles for participation in social, economic, and political life. We'll consider, as well, the roles of public education and other public spheres in working towards equity in a digital age.

**Literacy Considered**

Literacy and literacy pedagogies are vast topics. This chapter is not meant to be a review of literacy research or even literacy and technology research (such topics are covered extensively in other places; see chapters on technology in the *Handbook of Reading Research Volume III* or the *Handbook of Literacy and Technology*; 1998, as two possible starting points). This chapter will raise critical issues and questions about larger issues regarding the social construction of literacy. The defining and designing of literacies in the 21st century is a social process that, through ethical human agency, might be turned toward equitable democratic purposes (or might exacerbate current inequities).

When thinking about literacy new opportunities may come to mind, but literacy can also be used to erect barriers, as was the case with discriminatory literacy testing requirements in the U.S. South. So-called literacy laws were designed to bar African Americans from voting, even after the right to vote had ostensibly been secured through Civil Rights legislation. Robert P. Moses, the founder of the Algebra Project and advocate for mathematics literacy, worked as a civil rights worker in the South during the 1960s and describes the literacy laws in effect at the time. He notes that what African Americans were asked to read were often obscure constitutional passages that could not have been comprehended by the ruling Whites, who were not required to read them. In fact, during slavery, literacy itself was outlawed, making it illegal for slaves to learn to read and write and underscoring how literacy facilitates social action that may run counter to official purposes. As a present day
example, high-stakes standardized tests also serve a gatekeeping function and raise issues of cultural, racial and class biases, raising questions about who defines literacy and who is positively or negatively impacted (Moses & Cobb, 2001).

The Expansion of Literacy

Whatever the situation, you may reasonably associate literacy predominantly with visual artifacts—handwritten script, print text, and images, some might say the manipulation and interpretation of signs and symbols generally—as opposed to the strictly oral and aural experiences of speaking and listening. But even these distinctions can blur depending on your community, your values, or the technologies available to you. Digital technologies, for instance, facilitate the convergence of sound, text, and image, which can all be equally well encoded in the bits and bytes format of digital files. Literacy definitions that traditionally include descriptions of material processes of encoding and decoding meaning (usually alphabetic or other character rendering on paper), increasingly need to accommodate and make sense of digital rendering on digital media as well (e.g., digital data on floppy disks, CD-ROMs, and DVDs). These new media generate new enactments of literacy, and new social practices; consider, for example, computer-supported collaborative learning: collective and shared engagement with disciplinary content, databases, and varieties of information and communication technologies, usually over networked computers in the context of sociocultural learning theories and practices (Koschmann, 1996). Or, more prosaically, think of online karaoke.

If you speak into a microphone attached to a computer, speech-recognition software will “transcribe” (digitally convert) your words into text that displays on the screen. You can then store your text as a digital word processor file. In turn the word processor can “read” the text back to you through your computer’s speaker. In this example, as you work, are you speaking or writing, are you reading or listening, or both? What are the implications for literacy pedagogies? Both hardware and software mediate your literacy activities—a software program processes your keyboard input and is responsible as well for displaying the digital information which would be otherwise inaccessible were you simply handed the physical hard drive on which the digital data is inscribed.

E-mail, also, is a kind of hybrid of speech and writing, straddling, as it were, the technologies of letter writing and the telephone. Again by virtue of software (Internet protocols written in unspoken languages, another new form of literacy), e-mail is able to be distributed easily to multiple, even multitudinous participants worldwide, for multi-way communication. In another vein, understanding the contributing effects of audio (e.g., music and tone of voice) in television news show, alongside interpretations of visual text and images, is critical to media literacy. The use of diverse media may influence emotion and meaning, creating another challenge to strictly alphabetic or print notions of literacy.

Digital technologies increasingly shift text literacy from page to screen, creating, for example, new reading requirements (as well as new writing or, in the case of Web pages and multimedia, programming or authoring requirements) that include understanding how to navigate and make meaning of nonlinear text. Hypertext and hypermedia documents, where any text, image, or video may have embedded links to other text images and video, can be read, and in fact benefit by being read, in a nonlinear fashion. Clicking on a text or image link and
jumping from one screen to another involves active reader choice in deciding which links to follow. This affects the experience of what text is viewed in what order and the meaning-making process. Warschauer (2000) provides this summary of related skills for reading online:

- Finding the information to read in the first place (Internet searches, etc.)
- Rapidly evaluating the source, credibility, and timeliness of information once it has been located
- Rapidly making decisions as to whether to read the current page of information, pursue links internal or external to the page, or return back to further searching
- Making on-the-spot decisions about ways to save or catalogue part of the information on the page or the computer page itself
- Organizing and keeping track of electronic information that has been saved

Further, Warschauer (2000) notes the need for new writing/authoring skills:

- Integrating texts, graphics, and audiovisual material into a multimedia presentation
- Writing effectively in hypertext genres
- Using internal and external links to communicate a message well
- Writing for a particular audience when the audience is unknown readers on the World Wide Web
- Using effective pragmatic strategies in various circumstances of computer-mediated communications (e-mail, e-mail discussion lists, and various forms of synchronous real-time communication).

Beyond and aside from their language basis, emerging literacies are tied as well to visual image manipulation, sound integration, and the material resources and technologies available to a community, such as networked computers and the Internet and World Wide Web. Different material and technological resources in a community (as well as different values, aspirations, and activities) connote different literacies at work in that community. Digital equity is not simply an issue of equitable distribution of computers and connectivity, but, significantly, of the education, resources, and opportunities that support meaningful participation in the definition, design, and use of these technologies for self- and community-defined purposes.

It is useful to remember that what we currently know about social engagement with information and communication technologies derives largely from practices of and research on those with privileged access to the media (users are predominantly White, well-educated, and from families with relatively high incomes). At a recent conference on the design of online agents (in this case, animated talking heads in one corner of the computer screen able to interact in somewhat intelligent ways with online learners), I was struck that all of the animations I saw had White, European features. The researchers were interested in how learners might interact with these agents, but seemed not to give much thought to the variables of skin color, facial features, language, or accented speech as relevant factors that might affect different learners interactions differently. This experience underscores the reality that researchers often work within biases that favor dominant group members' perspectives, another face on the digital divide.
Official Literacies

Literacies are composed of diverse values and technologies. Consider, for the moment, whether you would agree that oral cultures and diverse cultural modes of expression and communication, including the use of art and visual images prominent in Aboriginal culture or the historical practice of sending smoke signals, for example, are as significant and worthy of privileged status as any dominant Western print-based literacy practices. What does it mean to value (or not) these divergent forms of expression in a digital age (or in any age)? What makes a type of literacy official or unofficial? How do literacies acquired in school relate to literacies acquired outside of school? Do literacies become official only insofar as they are associated with formal institutions, like schools? Are so-called unofficial literacies ever important to individual, family, and community well-being? If so, how and when, and what are the implications for public education?

Economically and politically, dominant or official literacies can and often do marginalize groups that engage in culturally diverse practices of communication and with non-dominant content. Digital technologies, democratically deployed, might support these varieties of cultural expressions and practices. Paul (2000) for example, sees rap and hip-hop generally as a site of critical inquiry, susceptible to media literacy strategies, engaging and didactically powerful for urban youth and able to provide a potential bridge between racially and culturally different teachers and students. She teaches critical media approaches to rap to preserve teachers as a way of addressing cultural barriers. Such an approach lends itself as well to critical multimedia authoring possibilities. In spite of such promising approaches, certain official forms of digital content still dominate most of our interactions with computers, e.g., corporate mass media, financial and business uses of largely office technologies, and standardized, top-down networked systems. This is not surprising since a key metaphor for our interface with computers has been the desktop (Johnson, 1997). Cultural and economic values are often implicitly, if not explicitly, embedded in the metaphors and designs of information and communication technologies. Likewise, the defining and designing of literacy (digital or otherwise), involves political decisions about what kinds of literacy count.

The International Adult Literacy Survey

Changing notions of literacy are reflected in international initiatives to understand literacy in various settings. The International Adult Literacy Survey (IALS), carried out by members of the Organization of Economic Co-operation and Development (OECD), was a 22-country initiative involving the survey of over 75,000 representative adults between 1994 and 1998, the largest international adult literacy study to date. The purpose of the comparative study is to “understand the nature and magnitude of the literacy issues faced by nations and to investigate the factors that influence the development of adult literacy skills in various settings—at home, at work and across countries” (Tuijnman, 2000, p. 9).

The study defines literacy as the ability to understand and employ printed information in daily activities, at home, at work and in the community—to achieve one’s goals, and to develop one’s knowledge and potential (Tuijnman, 2000, p. 9). This definition stays
within a fairly traditional print literacy perspective, in contrast to prior discussion in this chapter, but does provide some expansion in terms of linking print information to how it is used in the pursuit of individual goals and purposes. One might wonder, for instance, what occurs when individual goals or purposes diverge from dominant or even standards-based literacy notions?

Of note in the current testing-dominated K–12 climate is the instrumentation used in this adult literacy study. Literacy skills were evaluated along a multidimensional continuum (Tuijnman, 2000, p. 5). This highlights important concerns regarding literacy in the United States, as many literate members of U.S. society (based on testing) have trouble performing in ways that meet work and life demands. Literacy in this study is measured operationally across three domains, quoted from the study, below:

- **Prose literacy**—the knowledge and skills needed to understand and use information from texts including editorials, news stories, poems and fiction
- **Document literacy**—the knowledge and skills required to locate and use information contained in various formats, including job applications, payroll forms, transportation schedules, maps, tables and charts
- **Quantitative literacy**—the knowledge and skills required to apply arithmetic operations, either alone or sequentially, to numbers embedded in printed materials, such as balancing an account, figuring out a tip, completing an order form or determining the amount of interest on a loan from an advertisement (Tuijnman, 2000, p. 10).

Although promoting access to information and communication technologies (ICTs) is one of ten policy imperatives cited in the study, explicit reference to ICTs is scant. Further, the potential role of these and emerging technologies in addressing the other nine policy objectives is not explored. This is consistent with literacy definitions that stay at a basic adult literacy level (where literacy is thought of more as a minimum, than a high standard). However, the IALS study does raise the bar on the meaning of basic literacy. Notably the role of searching, finding, authenticating, and utilizing various types of documents is a highlighted literacy domain that brings fundamental information literacy skills into even basic conceptualizations of adult literacy. Information literacy is an arena in which digital technologies play an increasingly significant role (e.g., digital libraries) with regard to the organization, classification, analysis, and use of documents, including the use of metadata to digitally tag content (like a digital version of the information in a library card catalogue) and related data mining activities in the context of diverse human, organizational, and social practices. While the IALS definition and domains help in part to demonstrate that the knowledge economy and new information and communication possibilities are changing notions of basic adult literacy; they arguably do not go far enough in terms of the role of digital technologies in a new society.

**Changing Work in the New Economy**

The construction of official literacies and the setting of standards in education is generally a backward planning process. Hypotheses regarding the roles and functions of future citizens or workers become the basis of determining what adults should know and be able to
do. Certain views of the future often gain prevalence over others. Key ideas about changes in corporate capitalist work, for instance, affect the setting of standards.

Changes associated with information and communication technologies (ICTs), taken together with other social, scientific, and technological changes—such as the unraveling of genetic code, the rise of biotechnologies, improvements in transportation modes, and new economic structures and relations associated with globalization—contribute to the 21st century notion of global “knowledge workers” or “symbolic workers.” These ideas of what it means to be symbolic workers influence our sense of the literacies required to fulfill these roles. In 1993, business expert Peter Drucker proclaimed, “Knowledge is now fast becoming the one factor of production, sidelines both capital and labor. It may be premature (and certainly would be presumptuous) to call ours a ‘knowledge society’—so far we only have a knowledge economy. But our society is surely ‘post-capitalist’” (Drucker, 1998, p. 15). Drucker further states that human capital in the form of knowledge, talent, social networks, and the ability to learn and contribute to innovation and performance in the high-skills, service-oriented, information-based global economy may matter more than traditional forms of financial/material capital or labor. Gee (2000) views this as “people as portfolios” (p. 61). From a learning perspective, two cognitive psychologists active in the development of K–12 computer-supported collaborative learning environments contend that people must become expert at becoming experts (Bereiter & Scardamalia, 1993).

In the new economy corporate hierarchies are replaced by transnational partnerships, teamwork, and fluid, entrepreneurial enterprises, with a commensurate rise in jobs for consultants, part-time workers, and temporary workers. Further, calling someone a symbolic worker refers not only to the ability to understand and manipulate symbols through and within diverse media in order to accomplish complex tasks, but to recognize that the very marketing and dissemination of products and services in the 21st century involves understanding the role that these goods and services play as symbols in consumers’ lives. Thus, 21st-century literacies involve the manipulation of symbols by “symbolic workers,” in ways that relate fundamentally to issues of identity, community, consumer engagement, and economic participation. Becoming a knowledgeable citizen, as opposed to a knowledge worker, then, may entail developing the savvy to avoid being manipulated by symbolic practices related to increasing consumerism. While Drucker proclaims a “post-capitalist” world, Jeremy Rifkin (2000) and others characterize it somewhat differently as a hyper-capitalist world, what Rifkin terms an “age of access,” where the equivalent of subscription, licensed or fee-based access to key products and services, or even to lived, cultural experiences, is supereceding traditional forms of ownership, property, and experience. These authors suggest that actual ownership may reside in fewer and fewer hands (we, most of us, pay to use someone else’s things, rather than for the things themselves; think of Blockbuster or Time-Share vacation condos, for relatively mundane examples).

From an equity perspective these changes in our work environment represent both new possibilities and new threats. The social construction of future work seems to require a simultaneous devaluing of the skills, knowledge, and by association the contributions of agricultural, industrial, and so-called low-level service workers, or of artists and other forms of cultural workers, even when these workers arguably still provide the day-to-day backbone to both local and global economies. Thus, a wider range of diverse personal and cultural aspirations is not always included as we envision the new global world. Yet how the future is conceived determines the K–12 literacy standards we develop.
The Social Construction of Literacy in K–12 Education

To define something that every child should know and be able to do is to socially construct what it means to be literate, in some key sense of that term. I should explain here that social construction, in this instance, refers to the very concrete practice of experts (of whatever ilk) sitting around the proverbial table deciding and documenting what all children need to know and to be able to do usually at each grade level of their schooling in a given content domain (e.g., math, science, social studies, language arts). Standards setting can involve many people, sometimes thousands over a significant length of time, or only a relative few. Yet there is process of standards development, so it seems appropriate to describe as a process of social construction, with the understanding that the fact that it is social does not necessarily translate into it being either a particularly democratic or participatory.

Whether and when such standards-setting processes should be participatory is also an open question. Certainly relying on expert guidance in specific subject matter domains makes sense; mathematicians are well situated to identify important math concepts and knowledge. Yet questions and concerns arise. Consider E. D. Hirsch’s educational series based on his original book Cultural Literacy: What Every American Needs to Know, which sets out to describe what it means to be culturally literate in the United States in the 21st century. While this cultural literacy is presented as everything an American needs to know, it omits key histories, contributions, cultures, and values of the racially and ethnically diverse learners and their families least well-represented in the U.S. K–12 system, as well as those histories and perspectives that might inform an understanding of the United States place and role internationally. (Since September 11, 2001, this seems a particularly poignant omission, educational blinders as it were, codified as standards.) When considering digital content and digital technologies it is important as well to critically examine whose cultural values, representations, and expressions are given privileged status and whose are omitted or negated.

What is “official” literacy other than the range of practices, institutions, events, artifacts, and socially defined and valued competencies or enactments that come to be associated with dominant uses of the term? I had this in mind in posing the question that opened this chapter: What do you think of when you think of literacy? It is a pertinent question and any individual’s or group’s answer may or may not align with institutionally supported, official literacy definitions and further, will likely be determined in large part by the technologies with which one is comfortable and familiar. What are the implications in a democratic society of both differing views of literacy and technology-constrained literacy aspirations? Arguably educators need to understand and support the aspirations, values, and future visions of their learners’ diverse families and communities, as well as promote principled democratic participation in the wider society, including facilitating access to materials and technologies that might broaden learners’ and families’ notions of what is possible for them.

This chapter, and this book as well, suggest that it is in the scope of human ethical agency to proactively design learning that promotes equity in a digital age. Yet the social construction of literacy is multidimensional and as readily marked by conflict, contestation, and unequal power relations as by consensus, agreement, and participatory practices. Promoting equity involves ensuring that key stakeholders from traditionally underserved or oppressed groups are active participants in the processes of envisioning and designing social futures, in setting K–12 standards, and in designing quality learning activities. Further it is important that the aspirations and goals of traditionally underserved learners are
Multiple Intelligences

Changes in theories of learning also influence literacy notions and practices. In education, Gardner’s theory of multiple intelligences, for example, provides a framework for transforming teaching, learning, and assessment in ways that are still not widespread in U.S. classrooms. Gardner (1993) and his colleagues examined data from sources that include studies of normal child development as well as studies of exceptional individuals. They describe seven intelligences. The seven identified intelligences are: linguistic intelligence, logical-mathematical intelligence (most rewarded in school learning, along with linguistic intelligence, though in the United States with a rather strict English language bias), spatial intelligence, musical intelligence, bodily-kinesthetic intelligence, interpersonal intelligence (the ability to interact well with others), and intrapersonal intelligence (the ability to know yourself well enough to operate effectively in life). Each of these diverse intelligences might be reflected in different types of literacy enactments that can be associated with a given intelligence. These are not intended to be hard and fast categorizations of intelligence, but rather to point the way towards embracing a wider variety of literate performances and pedagogical approaches.

Gardner writes that the identification of these intelligences represent a “critique of a universalistic view of mind . . . [and supports] . . . the notion of an individual-centered school, one geared to optimal understanding and development of each student’s cognitive profile. This vision stands in direct contrast to that of the uniform school . . .” (1993, p. 9–10). People generally exhibit a spectrum of these intelligences, according to the theory, each of them on a continuum, with certain intelligences more or less pronounced in different individuals. The intelligences often work together in problem solving and, of course, in learning environments these intelligences will arise in diverse types of situated learning activities (bodily-kinesthetic intelligence will likely go unnoticed during a paper-and-pencil test, for instance). This facet of multiple intelligences creates some convergence with other theories of language and sociocultural learning that see linguistic competence and learning as situated in specific circumstances and activities that give them context and meaning (Koschmann, 1996; Lave & Wenger, 1991; Vygotsky, 1978). Theories of multiple intelligences also open the door for an expanded notion of the literacies associated with diverse type of intelligence.

Literacies as Technologies

In the United States, common usage of the term literacy often exceeds the type of definition employed in the International Adult Literacy Study, and refers not only to basic literacy or functional literacy, or even only to print literacy, but also to higher-order skills, like media literacy, information literacy, bi-literacy (literacy in two languages), and some of the other literacies mentioned throughout this chapter. Literacy may even refer to performance competencies such as those identified in the 1991 Secretary’s Commission on Achieving Necessary Skills (SCANS) Report. These work-related SCANS skills include initiative,
teammwork, ability to work with diverse co-workers, systems-thinking, appropriate technology use, and problem solving (all, arguably, deemed functional for participation in the 21st-century workplace). In a more recent report, the CEO Forum, a forum made up predominately of computer, media, and telecommunications executives, also embraces these workplace and computer technology "use" competencies as building blocks for student achievement, recommending these as fundamental to the schooling of a 21st-century citizenry and workforce. Literacies, then, tend to carry a connotation of being fundamentals, building blocks, things that ultimately undergird competence for participation in diverse aspects of society.

U.S. educators and policymakers likewise define literacy at times as "basic skills" while at other times redifining literacies across content areas in order to raise the bar of expectations for what every child should know and be able to do. These determinations are then codified as (hopefully) challenging content standards. Literacy, in this case, connotes any fundamental learning expectation we have for all K–12 learners, exceeding the simple encoding and decoding of text to include, for instance, academic literacy in content domains. Thus literacy toggles between being a floor and a raised bar. To not end up on the floor, one needs to aim for the bar. For many children this may mean exploring alternative paths of learning and literacy. With regard to the exploration of these alternative paths, literacy may also be conceived potently as critical literacy with a focus on empowerment, critique, democratic participation, and social transformation (Freire, 1982; Memik, Lee, & Okazawa-Rey, 1998; Nieto, 1996; Sleeter, 1996). Critical literacies interrogate existing power inequities in society. They help to raise the voices of and improve life chances for traditionally underserved or oppressed individuals and groups, as well as to promote education that supports social justice broadly.

Plainly the word literacy is over-determined and may even support contradictory connotations, or as Lemke (cited in Reinking, McKenna, Labbo, & Kieffer, 1998) describes it, "literacies are legion" and adds "that literacies are themselves technologies, and they give us the keys to using broader technologies. They also provide a key link between self and society: the means through which we act on, participate in, and become shaped by larger 'ecosocial' systems and networks" (Lemke, in Reinking, et al., 1998, p. 283). In the 21st century, and certainly throughout its history, literacy is and has been a moving target.

Oral Cultures, Literacy, and Digital Technologies

Societies without an alphabet or similar sign system of writing are often referred to as preliterate, privileging, rightly or wrongly, alphabetic or written sign-based literacy as an inevitable trajectory for all societies. Imagine the Greece of Homer and standing in a crowd listening to Homer recount the tale of the Iliad. How do you remember and recall the story when Homer is not there? Social gatherings, conversation, retelling of the story, architectural spaces, visual works of art, such as religious and hero-worshipping art, sculpture, crafts, all provide not only an aesthetic, practical, or social role, but serve importantly as mnemonic devices for sharing the stories and histories of communities and entire civilizations.

We do not have to limit ourselves to Western history and culture nor turn to Homeric Greece, for instance, for evidence of oral cultures today. Present-day nations and ethnic communities also live without written systems of signs, whether traditionally or due to language losses associated with colonialism and related forms of conquest and oppression.
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Some of these groups are even turning to digital means to document and rejuvenate their oral languages, cultures, and stories, or to revitalize or develop a written form of their language. Considering an example of a present day “preliterate” group provides some insight into the interactions of literacy, schooling and the wider society and the ways in which technologies mediate values as well as skills and knowledge.

The Nomadic Rabaris
In their ethnographic study of the Rabari nomads, a non-literate group, from Gujarat in the west of India, Dyer and Choksi (2001) consider the interactions of literacy, schooling, and development alongside the goals of the World Conference on Education for All. They note that underpinning the notion of basic education is a view of “neutral and universal” literacy, and go on to point out the assumptions surrounding many so-called neutral literacy education practices including the presumption of a settled, rather than mobile population, that is, a population available to attend sedentary classes. Such assumptions can put the state and the nomads at odds, with the nomads potentially perceived as difficult to control or belligerent, because their continuous movement is perceived as “a sort of offence to the requirements of any modern state” (Klute, quoted in Dyer & Choksi, 2001, p. 27). The state’s requirement to educate and develop literacy as it has defined literacy practices, on its own terms, can create the conditions for viewing the nomads as “problems.”

Migrant Education
Many traditionally underserved learners in a U.S. context are also often labeled as problems. This can be indicative, as in the experience of the Rabaris, of a mismatch in the literacy purposes and practices of schools and those of learners and their communities. Yet in some instances digital technologies are being implemented in ways designed to address the needs of diverse learners. Migrant students’ experiences reflect complex issues of mobility, race, culture, and class. Project Estrella developed with federal Technology Challenge Grant funding involves the use of satellite-television–transmitted educational programming and a laptop-lending program that migrant students use for their schoolwork and to connect to the Internet. They make use of online resources and interact with distant teachers via e-mail and other available forms of telecommunication. With this approach, participating migrant students attain a continuity in their educational program as they travel, and they develop sustained relationships with participating teachers over satellite and via telecommunications. Innovative program designs, supportive policies, funding, resources, appropriate educational personnel, and the involvement of learners, parents, and other community members are critical to projects like Estrella. We might call such approaches to learning “equitable education by design.”

Equitable Literacy
In conceptualizing a framework for equitable literacy in the digital age we should highlight important considerations. First, digital equity in education should not entail the devaluing or denigrating of oral cultures or other cultural technologies and practices that are not digital. In the K–12 context we should find ways to help learners become technologically literate in ways that go beyond conventional uses of that term. We need to help students understand that
technologies arise from, serve, and transform social purposes in situated contexts, reflect diverse experiences and histories, and may either reinforce or help transform an inequitable status quo. The identities, ways of being, knowledge, and, in some cases, wisdom of diverse communities are embedded in equally diverse varieties of art, architecture, storytelling, sculpture, fashion, language, technologies, and literacies. An equity perspective seeks to reduce inequities in decision-making power in order to help ensure that technology designs and uses do not disadvantage certain groups and communities while advantaging others, thereby increasing gaps and inequities. A good example, as shown in Project Estrella, is to set out with the explicit purpose of designing human and technology approaches that improve the participation and learning opportunities of traditionally underserved learners.

Toward Multiliteracies

In the 21st century, modes of literacy and opportunities for becoming literate through the use of digital technologies are purportedly multiple—so-called learn anytime, anywhere, technology-enhanced learning opportunities continue to increase in number and expand their reach. Groups like the U.S. Department of Education (2000) urge legislators to realize and facilitate the beneficial shift from narrow-band to broadband connectivity, from single mode (text) to multi-modal, rich connectivity (text, sound, images, video), from tethered (wired) access to untethered (wireless), and from the status quo of users adapting to the technology to an imperative of technology adapting to the users. Yet amidst these digital prescriptions education and opportunity divides persist based on familiar indices that include race, class, gender, language status, immigrant status, migrant status, and special needs. And as Don Tapscott (1999) warns in *Growing Up Digital*, the threat of “information apartheid” for those who are growing up without meaningful access to digital information and communication opportunities is very real.

An international group of literacy educators gathered in New London, New Hampshire, in 1994 to grapple with historic literacy issues, emerging literacy trends, and the future of literacy teaching. Now known as the New London Group, they have published jointly and individually and have coined their own conceptualization of multiliteracies, which is relevant to the discussion of literacies in this chapter:

Multiliteracies engage with the multiplicity of communication channels and media; and with the increasing salience of cultural and linguistic diversity. Mere literacy remains centered on language only. A pedagogy of multiliteracies, by contrast, focuses on modes of representation much broader than language alone. In some cultural contexts—in an Aboriginal community or in a multimedia environment, for instance, the visual mode of representation may be much more powerful. Multiliteracies also create a different kind of pedagogy: one in which language and other modes of meaning are dynamic representational resources, constantly being remade by their users as they work to achieve their various cultural purposes (Cope & Kalantzis, 2000, p. 5).

What does it mean for languages and other modes of meaning to become dynamic representational resources? The key evidently is for the resources to be in the hands of their users, for their own purposes. Resnik, Rusk, and Cooke (1999) of the MIT Media Lab, for example, make a related point in describing what they call technological fluency:
Technology fluency means much more than the ability to use technological tools; that would be equivalent to understanding a few common phrases in a language. To become truly fluent in a language (like English or French), one must be able to articulate a complex idea or tell an engaging story—that is, be able to “make things” with language . . . A technologically fluent person should be able to go from the germ of an intuitive idea to the implementation of a technological project. (Resnick, Rusk, & Cooke, 1999, p. 266)

Resnik, Rusk, & Cooke (1999) describe the design and experience of Computer Clubhouses, as places that promote learning, play, and use of advanced technologies in low-income communities. Children, youth, and adults come together in Computer Clubhouses and “mess around,” working on projects of their own devising. Children are as likely to coach adults in using new technologies as adults are to mentor children. Learning in the Clubhouses involves different members emerging as experts at different times, to assist or collaborate in learner-defined projects. This informal learning environment also provides a paradigm for one way to rethink traditional literacy practices.

Critical literacies may be especially needed in designing future literacy practices that promote digital equity. One might want to explore, for example, the kinds of literacies that would permit U.S. K–12 learners not merely to plug into already established or articulated institutions and social relations but might also point the way to collectively constructed alternate and equitable futures; multiple futures, perhaps, not yet imagined. Paulo Freire’s was a strong voice for such critical and transformative literacy.

**Freire and Transformative Literacy**

Twentieth-century Brazilian educator Paulo Freire advocated for and worked to develop critical, liberatory, and transformative literacies not merely of reading (interpreting) and problem solving, but of writing (acting) and problem posing. Otherwise one may become “literate” only in order to read about someone else’s reality and to solve someone else’s problems. Freire (1982) describes literacy simply, but profoundly as both “reading and writing the world” and “reading and writing the word.” Thus, he broadens fundamentally our view of literacy to include ways of “reading” (understanding and interpreting) the world in order to “write” (act in and transform) the world, with the reading and writing of texts, nevertheless, being instrumental to these broader endeavors. Further, by proposing that humans always “read and write the world,” whether or not they can yet “read and write the word,” Freire liberates us from the notion that we must set up such strict dichotomies between those who are “literate” and those who are not, underscoring that learners generally bring to literacy learning abilities and skills that are too often untapped in narrow approaches to literacy development.

For Freire (1982), literate adults benefit from engaging in spiraling cycles of action, reflection, and dialogue, called praxis, learning through experience, thought, and social interaction to discern both what is natural (and perhaps objective and immutable in the world) and what is cultural or historical (human-made, designed, and susceptible to change) in order to then participate in social action and processes of change for individual and communal well-being. Culture and history are exclusively human domains; and full humanity, for Freire, is measured significantly by the ability to be an active subject, a critically conscious shaper of culture and history. Oppression is the condition of being a human object, rather than a subject, at best adapting to historical and cultural realities imposed by others; schools facilitate these kinds of objectifying impositions, sometimes in the guise of
ostensibly benevolent goals of "assimilation" or "mainstreaming." Critical education, which becomes requisite for equitable education and equitable literacy, in Freire's sense, is incomplete unless it includes analyses of power. Who decides in literacy learning environments which cultural and educational norms to impart? Who is positively or adversely impacted? Who imposes meaning and structure? Who lives as subject and who as object? Why? How can oppression be transformed into liberation? Literacy that empowers (and not all self-described literacy practices do) is a key.

21st-Century Literacies, Equity, and the Telling of Stories

In the 21st-century "knowledge society," with its vastness of data contributing too often to information smog and information overload, storytelling is acknowledged to be a critical organizer of human knowledge, potentially combining multiple perspectives, moral values, mental images, affect and propositional knowledge to facilitate human understanding and communication and to inform and coordinate purposive human action. What follows are brief stories from current K–12 contexts that provide suggestive examples of how digital technologies may help to shape equitable literacies and learning.

Project Fresa

In Oxnard, California third- and fifth-grade Spanish/English bilingual students, children of strawberry farmworkers, use a variety of technologies—tape recorders, video cameras, digital still cameras, scanners, computer software, and the Internet—for in-depth exploration of their own community as well as for collaborative inquiry into the lives of other farmworker communities nationally. Project Fresa participants (fresa is the Spanish word for strawberry) develop bilingual interview and research questions to find out, among other things, how long members of their families have worked in the fields, how much they make per box of strawberries picked, and why many suffer from headaches and back pain. They use spreadsheets to create pie charts and bar graphs of interview responses, and publish these on the World Wide Web.

The students create art that is then digitized, develop biliteracy through the writing of poetry and journal entries (using word processors and Web page publishing software), and carry out geography and social studies research on the Internet regarding strawberry production nationally and internationally, using off-line resources as well—books, journals, and newspapers. They also become aware of and research the dangers to their parents of fertilizer and pesticide use in the fields and mount e-mail and letter writing efforts to express their concern and to call for appropriate safety measures. Further, as part of an e-mail-based learning network project they connect with the children of coffee farmworkers in Puerto Rico in order to collect and share similar data and stories and to discuss and analyze the similarities and differences of their lives and struggles in diverse, low-income agricultural communities. These Oxnard students have these new literacy and learning opportunities in significant part due to the vision, expertise, and technology-use competencies of their bilingual teachers. They still have only limited access to digital technologies but have many ideas for what they could do with greater access.
Southeast Asian Educators and Students

A group of conference attendees sits at individual computers in a conference "hands-on" session. If you look over their shoulders you'll see that they are making painstaking progress using a basic paint program to draw what to untrained eyes look simply like beautiful designs—some intricate, some made up of simple strokes of black. This is not a technology conference. This is the conference of the California Association of Bilingual Educators (CABE) and the participants in this hands-on session provided by the Center for Language Minority Education and Research (CLMER) include educators of Cambodian, Vietnamese, Chinese, Laotian or Hmong descent, as well as a few white American educators fluent in the languages of these ethnic groups, who also teach in K–12 bilingual education programs. This is not a session on technology and the arts. The attendees are learning from their colleagues the strategies, tricks, and tips they have devised for creating Web pages that can include the character scripts of the languages of their students and of their own Southeast Asian American communities.

The American Standard Code for Information Interchange (ASCII) which has dominated computer technologies for decades makes use of a 7-bit code space and its 8-bit extension to represent Roman characters, specifically A–Z and a–z. In short, ASCII does not support the non-Roman characters of participants' languages. The newer Unicode Standard allows for virtually any extant character within world languages, yet is not fully implemented in all software programs, especially not in the dated software most readily available in high-poverty K–12 classrooms. The ASCII Standard reminds us that exclusion from certain literacy practices can take place at the level of what might seem to be innocent or neutral technical standards that, in reality, reflect and reinforce the values and purposes of those who designed them.

Native Americans/American Indians

Baldwin (1995) notes that the rapid evolution of communication technologies played a role in the European invasion of the "New World" (at that time, changes in print distribution and transportation technologies), that TV and radio came late to reservations, with relevant cultural content coming even later, while simple telephone service is still far from universal today. Internet use and participation in cyberspace remains an elusive goal on many reservations, though participation is growing. Implementation of new communication technologies also involves the complex cultural responses of diverse tribes with as much concern about the threats of new technologies as there may be hopes for its potential. For example, Baldwin writes, "Indian people who use the public data networks are now asking, 'How do we implement the principles of tribal sovereignty and self-determination online?'" (Baldwin, 1995, p. 143).

One nation, the Oneida Nation, early-adopters of Internet technologies, created an online Treaties Project, to educate their children and others about their tribe's treaties with the U.S. government. Yet besides creating new kinds of literacy acts (digital publishing) and modes of communication, cyberspace creates new challenges to cultural identity, according to Baldwin (1995). Internet aficionados often extoll the virtues of being able to assume different identities and to role-play in the relative anonymity of cyberspace. Yet such fluid forms of identity can pose a threat to tribes to identify who can speak for the tribe, a right
they would like to see carried over into cyberspace. And the stereotypes of archaic Indians need to be dismantled, according to Baldwin (1995):

This stereotype clashes with the reality of the tribal councilmen who are now considering the use of reservation lands as a storage site for nuclear and medical waste. Or the tribal council that must choose which subcontractors should design software that will integrate casino and bingo operations with overall tribal budgets. Or the tribal planner utilizing a Geographic Information System to track development of tribal roads and industry, a satellite network of Indian-owned and -operated radio stations, or a national satellite video network of Indian colleges (p. 140).

Issues of physical infrastructure and access are, perhaps more than ever, critical to Native American/American Indian participation in new forms of literacy and communication; additionally, a wider range of sociocultural issues is implicated in ensuring digital equity, the maintenance of treaty rights and tribal sovereignty.

**Kansas Collaborative Research Network (KANCRN)**

K–12 participants in this online community of scientific inquiry follow guided processes that include generating research questions, engaging in field and online research, hypotheses development and testing, data collection, use of collectively populated databases, analysis and development of online software-supported Geographic Information Systems (GIS) visualizations, and database-driven maps based on students’ own collected data as well as public and private data sets. K–12 participants collaborate with peers online—sharing data, visualizations, and analysis, and writing or co-writing research papers. Through KANCRN, participants also collaborate with adult experts and scientists, often at a distance. One young participant identified a new species of a studied animal and co-presented a paper at a conference in Northern Europe with an internationally known expert. Through KANCRN, scientific and social science literacies, database manipulation, and use of visualization and data modeling are integrated into new information and communication technology-enhanced forms of teaching and learning for those teachers, learners, and communities privileged with the capacities to participate digitally.

**Community Technology Centers**

During the 1992 “disturbances,” or uprisings, in South-Central Los Angeles one African American community leader, Joseph Loeb, watched his community literally go up in flames fueled by anger and historical patterns of neglect. Joseph decided he had to do what he could to make a difference. He quit his job, sold his car, and cleared out his garage to set up a makeshift computer lab to start teaching computer skills to inner-city children and youth, as a way of providing new skills and hope for an economically brighter future. Joseph and many more committed members of the community then opened two or three small community technology centers before the newly formed Break Away Technologies found a home in a 15,000 square foot facility near Jefferson and Crenshaw in Los Angeles. Break Away Technologies became an after-school and weekend center for inner-city children, youth, and adults. It became a point of training and access for community-based arts,
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nonprofit, and economic development organizations, and, among many other programs, initiated a successful CyberSeniors program, with many seniors developing high-tech entrepreneurial skills and becoming mentors to neighborhood children and youth. Further, Break Away Technologies, through high-speed connections to an Internet gateway at University of Southern California, became an Internet Service Provider, providing access to online services as well as to training, support, computer recycling programs, and networking services for community organizations and inner-city schools.

In collaboration with the Center for Language Minority Education and Research (CLMER), Break Away became a community site for the “Computers in Our Future” (CIOF) Initiative of The California Wellness Foundation. Over four years Break Away collaborated with ten similar sites statewide to develop new operational visions for community-based and -managed open access, education, training, and support centers where underserved youth and adults can gain access to and develop competencies in using, building, and maintaining computer and network technologies—including using computers and the Internet for personal, academic, and job-related learning activities, engaging in Web page development as well as in multimedia, animation, and graphic design activities, and developing work readiness. Break Away and CLMER also collaborate on a federally funded Community Technology Centers project that supports Break Away’s ongoing vision and operations. Further, Break Away Technologies with assistance from CLMER and in collaboration with a variety of private and public partners has helped to bring computers and network technologies to over 200 community-based organizations and schools through its “200 by 2000” initiative.

Yet community-based movers and shakers are not deluded. They recognize that computers and the Internet are not panaceas, but are most useful when addressing specific learning issues and social purposes in the context of appropriate additional resources, expertise, and community goals. They also understand that donated computers, better than none at all, become quickly outdated for running new software programs, installing memory-hungry new versions of operating systems, or for addressing evolving network requirements. Yet savvy members of low-income and economically distressed communities who recognize the value of 21st-century literacies are helping themselves and each other to the benefits of networked and relevant digital literacy opportunities, even when steady and stable streams of appropriate public funding, resources, and professional development support that would ensure meaningful participation for their communities are not otherwise available.

**Literacy Transformations at All Grade Levels**

Leu (2000) sees technology changes as creating rapidly and continuously changing literacies in K–12 contexts at all grade levels. Literacy practices one day may change the next, with, for instance, the introduction of handheld digital assistants and scientific probes. He invites us to consider some classrooms at all grade levels that already make use of networked technologies in ways that are likely still novel in too many classrooms and especially in the classrooms of traditionally underserved learners. For example, children in K–2 classrooms in Portland, Oregon, have kept a pet gerbil in a terrarium; they have also had in the past a GerbilCam, a 24-hour Internet camera, allowing the children to make observations of the gerbil’s behaviors and habits over the Internet from home or from other places...
in the school or community. Children’s artwork and writing about their gerbil observations and projects have become part of online digital electronic portfolios. This kind of use of computer technologies for learning is motivating. With appropriate facilitation by teachers, students might also develop nascent ethical sensibilities about scientific and surveillance uses of video, which may inform dialogues at various grade levels around issues of privacy rights for humans or the ethical treatment of animals in scientific experiments.

A video vignette developed by the North Central Regional Education Laboratory (NCREL) depicts upper elementary and middle school students participating with other classrooms in a Windmill Project facilitated over the Internet by the Franklin Institute in Philadelphia, Pennsylvania. Students design and build windmills of various shapes and materials, sharing their design choices with collaborative classroom partners at a distance using CUSeeMe Internet videoconferencing software (preferably over high-bandwidth connections). By sharing their budding theories of aerodynamics and receiving peer feedback at a distance, students develop speaking and presenting abilities, may share written plans and drawings as well, and come to experience processes of peer review and iterative design that mirror experiences of adult engineers, inventors, and designers.

The students depicted in the Windmill Project are predominantly white, English-only students in a multiple computer classroom with extensive hands-on materials for their windmill construction project. On the one hand, that they are well-resourced helps us at least to get some glimpse of the potential of information and communication technologies in education; on the other, similarly resourced schools with high numbers of linguistically, racially, and culturally diverse underserved learners might lead to yet other innovative project ideas, like a higher-tech Project Fresa focused on issues of agriculture and agricultural workers, or the First Peoples global learning network project linking indigenous children internationally in sharing powerful, digitized artwork and stories about their diverse indigenous communities.

Towards Digital Equity

In the 21st century, new gaps open in and around “reading and writing the word” and “reading and writing the world,” within which newly acknowledged intelligences along with literacies and technologies, like those discussed in this chapter, proliferate. Manuel Castells (2000) in his book *The Rise of the Network Society* draws upon Melvin Kranzberg’s first law of technology, which is that “technology is neither good nor bad, nor is it neutral” (Castells, 2000, p. 76). Expanding on this notion I’d like to suggest that literacy practices and other associated educational practices are also neither inherently bad nor good, nor are they neutral, but are always already embedded political endeavors with human agency and historical conditions interacting to shape those practices and their outcomes. If, as Luu suggests, literacies change with technologies and material resources (and especially rapidly in a digital age), and if equitable public education in a democracy is ostensibly based on equitable literacy opportunities for all learners, a failure to provide equitable material and technological resources to all learners is tantamount to denying access not merely to these specific materials and technologies, but more importantly to the literacies that are not possible without them. The struggle of human agents who care about equity is to marshal educational practices and technology uses to equitable ends.