Reconstructing Technoliteracy: A Multiple Literacies Approach
By Richard Kahn and Douglas Kellner

> The great advance of electrical science in the last generation was closely associated, as effect and as cause, with the application of electric agencies to means of communication, transportation, lighting of cities and houses, and more economical production of goods. These are social ends, moreover, and if they are too closely associated with notions of private profit, it is not because of anything in them, but because they have been deflected to private uses: a fact which puts upon the school the responsibility of restoring their connection in the mind of the coming generation, with public scientific and social interests.
> -- John Dewey (1916)

The ongoing debate about the nature and benefits of technoliteracy is without a doubt one of the most hotly contested topics in education today. Alongside their related analyses and recommendations, the last two decades have seen a variety of state and corporate stake holders, academic disciplinary factions, cultural interests, and social organizations ranging from the local to the global weigh in with competing definitions of "technological literacy." Whereas utopian notions such as Marshall McLuhan's "global village" (1964) and H.G. Wells's "world brain" (1938) imagined a technological world of growing unity in diversity, our's is perhaps better characterized as the highly complex and socio-politically stratified global culture of media spectacle[1] and the ever-developing mega-technics of a worldwide information (Castells 1996), cum technocapitalist infotainment society (Kellner 2003a: 11-15). As such, there is presently little reason to expect general agreement as regards what types of knowledge are entailed by technoliteracy, what sorts of practices might most greatly inform it, or even as to what institutional formations technoliteracy can best serve and be served by in kind. Further, despite the many divergent and conflicting views about technoliteracy that presently exist, it is only relatively recently that existing debates have begun to be challenged and informed by oppositional movements based on race, class, gender, anti-imperialism, and the ecological well-being of all. As these varying movements begin to ask their own questions about the ever-dovetailing realms of technology and the construction of a globalized culture, political realm, and economy, we may well yet see technoliteracy at once become more multiple in one sense, even as it becomes more and more singularly important for all in another.[2]

---

[1] On the concept of "media spectacle" see Kellner (2005, 2003a); it builds upon Guy Debord's notion of the "society of the spectacle," which describes a media and consumer society organized around the production and consumption of images, commodities, and staged events and defines those phenomena of media culture that embody contemporary society's basic values, serve to initiate individuals into its way of life, and dramatize its controversies and struggles, as well as its modes of conflict resolution.

[2] The idea that different forms of knowledge (e.g.; different types of questions which in turn beget different answers) are produced as an oppressed group begins to achieve a collective identity vis-à-vis the social, cultural, and political issues of the day is a central insight of the critical theory known as feminist standpoint theory (Harding 2004). It can be argued that

Much has been written that describes the history of the concept of "technological literacy" (Petrina 2000; Selfe 2000; Jenkins 1997; Waetjen 1993; Lewis and Gagel 1992; Dyrenfurth 1991; Todd 1991; Hayden 1989) and, as noted, a literature attempting to chart emancipatory technoliteracies has begun to emerge over the last decade (Kellner 2004, 2003c, 1998; Lankshear & Snyder 2000; Petrina 2000; Luke 1997; Bromley and Apple, 1998; Ó Tuathail and McCormack 1998; Burbules and Callister 1996; McLaren, Hammer, Sholle & Reilly, 1995). We do not seek to reinvent the wheel here or reproduce yet another account of the same. Yet, considering that tremendous variance exists in the published definitions of technoliteracy, it will prove fruitful to begin with a brief examination of the meanings that "technology" and "literacy" have received towards achieving with more precision exactly what sort of knowledge and skills "technoliteracy" hails.

From this, we will seek to summarize the broad trajectories of development in hegemonic programs of contemporary technoliteracy from their arguable origins as "computer literacy" in the United States' *A Nation at Risk* report of 1983, through the Clinton years and the economic boom of information-communication technologies (ICTs) in the 1990s, up to the present call for integration of technology across the curriculum and the standards-based approach of the *No Child Left Behind Act of 2001* and 2004's U.S. *National Educational Technology Plan.* Agreeing with Petrina (2000), that such development is largely the construction of a neutralized version of technoliteracy which bolsters a conservative politics of ideological "competitive supremacy," we will show how this has been tacitly challenged at the global institutional level through the United Nations' Project 2000+.

In following, we analyze how these contestations link up with the oppositional democratic project for the re-visioning of education though multiple literacies. Finally, in closing, we think about what it will mean to reconstruct "technoliteracies" in light of our discussion, as we propose that a major goal will be to involve people in the large-scale movements to actively transform mainstream understandings, policies, and practices of technoliteracy through the politicization of the hegemonic norms that currently pervade social terrains.

Technology, Literacy, Technoliteracy: Definitions

> "Technological literacy is a term of little meaning and many meanings."
> -- R.D. Todd (1991)

Upon first consideration, seeking a suitable definition of "technology" itself appears to be overly technical. Surely, in discussions concerning technology, it is rare indeed that people need to pause so as to ask for a clarification of the term. In a given context, if it is suggested that technology is either causing problems or alleviating them, people generally know what sort of thing is due for blame or praise.

Yet, the popular meaning of "technology" is problematically insufficient in at least two ways. First, it narrowly equivocates technological artifacts with "high-tech," such as those scientific machines used in medical and biotechnology, modern industrial apparatuses, and digital components like computers, ICTs, and other electronic media.

---

this idea girds critical theory in general, and a radical formulation can be seen in Marcuse (1965), as well as in the works of Marx and Engels proper as Sandra Harding points out.

This reductive view fails to recognize, for instance, that indigenous artifacts are themselves technologies in their own right, as well as other cultural objects that may once have represented the leading-edge of technological inventiveness during previous historical eras, such as books, hand tools, or even clothing. Secondly, popular conceptions of technology today make the additional error of construing technology as being merely object-oriented, identifying it as only the sort of machined products that arise through industry. In fact, from the first, technology has always meant far more; and this is reflected in recent definitions of technology as "a seamless web or network combining artifacts, people, organizations, cultural meanings and knowledge" (Wajcman 2004: 106) or that which "comprises the entire system of people and organizations, knowledge, processes, and devices that go into creating and operating technological artifacts, as well as the artifacts themselves" (Pearson and Young 2002).

These broader definitions of technology are supported by the important insights of John Dewey. For Dewey, technology is central to humanity and girds human inquiry in its totality (Hickman 2001). In his view, technology is evidenced in all manner of creative experience and problem-solving. It should extend beyond the sciences proper, as it encompasses not only the arts and humanities, but the professions, and the practices of our everyday lives. In this account, technology is inherently political and historical and in Dewey's philosophy it is strongly tethered to notions of democracy and education, which are considered technologies that intend social progress and greater freedom for the future.

Dewey's view is hardly naïve, but it is unabashedly optimistic and hopeful that it is within the nature of humanity that people may be sufficiently educated so as to be able to understand the problems which they face and, thusly, that people can experimentally produce and deploy a wide range of technologies so as to solve those problems accordingly. While we agree strongly with the spirit of Dewey, we also recognize that the present age is potentially beset by the unprecedented problem of globalized technological oppressions in many forms.

To this end, we additionally seek to highlight the insights of radical social critic and technology theorist Ivan Illich (Kahn and Kellner *forthcoming*). Specifically, Illich's notion of "tools" mirrors the broad humanistic understanding of technology outlined so far, while it additionally distinguishes "rationally designed devices, be they artifacts or rules, codes or operators…from other things such as food or implements, which in a given culture are not deemed to be subject to rationalization" (Illich 1973: 22). Consequently, Illich polemicizes for "tools for conviviality," which are technologies mindfully rationed to work within the balances of both cultural and natural limits. In our view, technology so defined will prove useful for a 21st century technoliteracy challenged to meet the demands of a sustainable and ecumenical world.

"Literacy" is another concept, often used by educators and policy makers, but in a variety of ways and for a broad array of purposes. In its initial form, basic literacy equated to vocational proficiency with language and numbers such that individuals could function at work and in society. Thus, even at the start of the 20th century, literacy largely meant the ability to write one's name and decode popular print-based texts, with the additional goal of written self-expression only emerging over the following decades. Street (1984) identifies these attributes as typical of an autonomous model of literacy that is politically conservative in that it is primarily economistic, individualistic, and is driven by a deficit theory of learning. On the other hand, Street characterizes ideological models

of literacy as prefiguring positive notions of collective empowerment, social context, the encoding and decoding of non-print-based and print-based texts, as well as a progressive commitment to critical thinking-oriented skills.

In our conception, "literacy" is not a singular set of abilities but is multiple and comprises gaining competencies involved in effectively using socially constructed forms of communication and representation. Learning literacies requires attaining competencies in practices and in contexts that are governed by rules and conventions and we see literacies as being necessarily socially constructed in educational and cultural practices involving various institutional discourses and pedagogies. Against the autonomous view that posits literacy as static, we see literacies as continuously evolving and shifting in response to social and cultural changes, as well as the interests of the elites who control hegemonic institutions. Further, it is a crucial part of the literacy process that people come to understand hegemonic codes as "hegemonic." Thus, our conception of literacy follows Freire and Macedo (1987) in conceiving literacy as tethered to issues of power. As they note, literacy is a cultural politics that "promotes democratic and emancipatory change" (viii) and it should be interpreted widely as the ability to engage in a variety of forms of problem-posing and dialectical analyses of self and society.

Based on our definitions of "technology" and "literacy" it should be obvious that, holistically conceived, literacies are themselves technologies of a sort--meta-inquiry processes that serve to facilitate and regulate technological systems. In this respect, to speak of "technoliteracies" may seem inherently tautological. On the other hand, however, it also helps to highlight the constructed and potentially reconstructive nature of literacies, as well as the educative, social, and political nature of technologies. Further, more than ever, we need philosophical reflection on the ends and purposes of education and on what we are doing and trying to achieve in our educational practices and institutions. Such would be a technoliteracy in its deepest sense.

Less philosophically, we see contemporary technoliteracies as involved with the need to comprehend and make use of proliferating high-technologies, and the political economy that drives them, towards furthering radical democratic understandings and transformations of our worlds. In a world inexorably undergoing processes of globalization and technological transformation, we cannot advocate a policy of clean hands and purity, in which people shield themselves from new technologies and their transnational proliferation.[3] Instead, technoliteracies must be deployed and promoted that allow for popular interventions into the ongoing (often anti-democratic) economic and technological revolutions taking place, thereby potentially deflecting these forces for progressive ends like social justice and ecological well-being.

In this, technoliteracies encompass the computer, information, critical media, and multimedia literacies presently theorized under the concept "multiliteracies" (Cope and Kalantzis 2000; Luke 2000, 1997; Rassool 1999; New London Group 1996). But whereas multiliteracies theory often remains focused upon digital technologies, with an implicit thrust towards providing new media job skills for the Internet age, we seek to explicitly

---

[3] Though, stressing the social and cultural specificity of technologies, neither are we calling for the universal adoption of high-technologies, nor do we link them essentially to progress as necessary stages of development. On the other hand, we urge caution against technophobic attitudes, as we favor a dialectical view of technology and society.

highlight the social and cultural appropriateness of technologies and provide a critique of the new media economy as technocapitalist (Best and Kellner 2001; Kellner 1989), while acknowledging its progressive potentials. Thus, we draw upon the language of "multiple literacies" (Lonsdale and McCurry 2004; Kellner 2000) to augment a critical theory of technoliteracies as will be expounded upon later.

Functional and Market-based Technoliteracy: United States

> From being a Nation at Risk we might now be more accurately described as a Nation on the Move. As these encouraging trends develop and expand over the next decade, facilitated and supported by our ongoing investment in educational technology…we may be well on our way to a new golden age in American education.
>
> -- U.S. Department of Education (2004)

The very fledging Internet, then known as the ARPANET due to its development as a research project of U.S. Defense Advanced Research Projects Agency (DARPA), was still a year away when the *Phi Delta Kappan* published the following utopian call for a computer-centric technoliteracy:

> Just as books freed serious students from the tyranny of overly simple methods of oral recitation, so computers can free students from he drudgery of doing exactly similar tasks unadjusted and untailored to their individual needs. As in the case of other parts of our society, our new and wondrous technology is there for beneficial use. It is our problem to learn how to use it well (Suppes: 423).

However, it was mainly not until *A Nation at Risk* (1983) that literacy in computers was popularly cited as particularly crucial for education.

The report resurrected a critique of American schools made during the Cold War era that sufficient emphases (specifically in science and technology) were lacking in curriculum for U.S. students to compete in the global marketplace of the future, as it prognosticated the coming of a high-tech "information age." Occurring in the midst of the first great boom of personal computers (PCs), *A Nation at Risk* recommended primarily for the creation of a half-year class in computer science that would:

> equip graduates to: (a) understand the computer as an information, computation, and communication device; (b) use the computer in the study of the other Basics and for personal and work-related purposes; and (c) understand the world of computers, electronics, and related technologies (National Commission on Excellence in Education 1983).

While *A Nation at Risk* declared that experts were then unable to classify "technological literacy" in unambiguous terms, the document clearly argues for such literacy to be understood in more functional understandings of computer (Aronowitz 1985; Apple 1992) and information (Plotnick 1999) literacy. Technology, such as the computer, was to be seen for the novel skill sets it afforded and professional discourse began to hype the "new vocationalism" in which the needs of industry were identified as educational priorities (Grubb 1996). Surveying this development, Stephen Petrina (2000) concludes, "By the mid-1980s in the US, technology education and technological literacy had been defined through the capitalist interests of private corporations and the state" (183) and Besser (1983) underscores the degree to which this period was foundational in

constructing education as a marketplace.

The 1990's saw the salience and, to some degree, the consequences of such reasoning as the World Wide Web came into being and the burgeoning Internet created an electronic frontier "Dot-Com" economic boom via its commercialization in a range of personal computing hardware and software. In the age of Microsoft and America Online, computer and information skills were indeed increasingly highly necessary. Al Gore's "data highway" of the 1970s had grown an order of magnitude to become the "information superhighway" of the Clinton presidency and the plan for a "Global Information Infrastructure" was being promoted as "a metaphor for democracy itself" (Gore 1994) as social and technological transformation ignited globally under the pressures of the "new economy" (Kelly 1998).

By the decade's end, technological literacy was clearly a challenge that could be ignored only at one's peril. Yet, in keeping with the logic of the 1980's, such literacy was again narrowly conceived in largely functional terms as "meaning computer skills and the ability to use computers and other technology to improve learning, productivity, and performance" (U.S. Department of Education 1996). Specifically, the Department located the challenge as training for the future which should take place in schools, thereby taking the host of issues raised by the information revolution out of the public sphere proper and reducing them to standardized technical and vocational competencies for which children and youth should be trained. Further, technological literacy, conceived as "the new basic" (U.S. Department of Education 1996) skill, became the buzz word that signified a policy program for saturating schools with computer technology as well as training for teachers and students both. Thereby, it not only guaranteed a marketplace for American ICT companies to sell their technology, but it created entirely new spheres for the extension of professional development, as teachers and administrators began to be held accountable for properly infusing computer technology into curricula.

Come the time of the Bush administration's second term, the U.S. National Education Technology Plan quoted approvingly from a high schooler who remarked, "we have technology in our blood" (U.S. Department of Education 2004: 4), and the effects of two decades worth of debate and policy on technoliteracy was thus hailed as both a resounding technocratic success and a continuing pressure upon educational institutions to innovate up to the standards of the times.[4] Interestingly, however, the Plan itself moved away from the language of technological literacy and returned to the more specific term "computer literacy" (13). Still, in its overarching gesture to the *No Child Left Behind Act of 2001,* which had called for technology to be infused across the curriculum--meaning the use of multimedia computers and the Internet across the arts and sciences--and for every student to be "technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability" (U.S. Congress 2001), the United States demonstrated its ongoing commitment to delimit "technological literacy" in the functional and economistic terms of computer-based competencies.[5]

---

[4] A definition of "technocracy" is offered by Kovel (1983: 9) as being the social order where "the logic of the machine settles into the spirit of the master. There it dresses itself up as 'value-free' technical reasoning."

[5] In 2002, the International Technology Education Association issued its *Standards for*

Technoliteracy for Sustainable Development: United Nations

> Who benefits, who loses? Who pays? What are the social, environmental, personal, or other consequences of following, or not following, a particular course of action? What alternative courses of action are available? These questions are not always, and perhaps only rarely, going to yield agreed answers, but addressing them is arguably fundamental to any educational program that claims to advance technological literacy for all.
>
> -- Edgar W. Jenkins (1997)

In order to chart trajectories in technoliteracy at the international level, we now turn to a brief examination of the United Nations' Project 2000+: Scientific and Technological Literacy for All. In 1993, UNESCO and eleven major international agencies launched Project 2000+ in order to prepare citizens worldwide to understand, deliberate on, and implement strategies in their everyday lives concerning "a variety of societal problems that deal with issues such as population, health, nutrition and environment, as well as sustainable development at local, national, and international levels" (Holbrook, et al. 2000: 1). The project's mission underscores the degree to which the United Nations conceives of technological literacy as a social and community-building practice, as opposed to an individual economic aptitude. Further, in contradistinction to the functional computer literacy movements found in the United States context, the U.N.'s goal of "scientific and technological literacy" (STL) for all should be seen as connected to affective-order precedents such as the "public understanding of science" (Royal Society 1985) and "science-technology-society" (Power 1987) movements.

Though directly inspired by the social development focus of 1990's World Declaration on Education, Project 2000+ also draws in large part from the Rio Declaration on Environment and Development agreed upon at the 1992 Earth Summit (UNESCO 1999). While the Rio Declaration itself contains ample language focused upon the economic and other developmental rights enjoyed by states, such notions of development were articulated as inseparable from the equally important goals of "environmental protection" and the conservation, protection, and restoration of "the health and integrity of the Earth's ecosystem" (United Nations 1992). "Sustainable development," defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987), cannot be properly separated from radical critiques of ecologically damaging political economy and other social behavior. Yet, neither can it be separated from the ability of people everywhere to gain access and understanding of the information that can help to promote sustainability.

Technological Literacy: Content for the Study of Technology, which intends to be definitive for the field. To be fair, at least 8 of its 20 standards evoke the possibility of affective components that move beyond the functional, market-based approaches chronicled here. However, as Petrina (2000: 186) notes, the Director of the Technology for All Americans project involved in creating the standards declared that they were "the vital link to enhance America's global competitiveness in the future" and so their vocational and economic concerns must be considered central.

UNESCO does not make ICTs a centerpiece of STL projects, however. Of course, a major reason that UNESCO downplays an emphasis upon computer-related technology in its approach to technoliteracy is because the great majority of the illiterate populations it seeks to serve are to be found in the relatively poor and un-modernized regions of Latin America, Africa, and Asia, where an ICT focus would have less relevance at present. A more comprehensive reason, however, is that the United Nations has specifically adopted a non-functional commitment to literacy, conceiving of it as multiple literacies "which are diverse, have many dimensions, and are learned in different ways" (Lonsdale and McCurry 2004: 5). STL, then, calls for understandings and deployments of appropriate technology--the simplest and most sustainable technological means which can meet a given end--as part of a commitment to literacy for social justice and human dignity. This is far different than in the United States, where technoliteracy has generally been reduced to a program of skills and fluency in ICTs.

Still, it would be incorrect to conclude that the United Nations is anti-computer. In fact, the institution is strongly committed to utilizing ICTs as part of its literacy and development campaigns worldwide (Wagner and Kozma 2003; Jegede 2002) whenever appropriate. But as it is also conscious of the ability of new technologies to exacerbate divides between rich and poor, male and female, and North and South, the United Nations promotes "understanding of the nature of, and need for, scientific and technological literacy in relation to local culture and values" (UNESCO 1999) and believes that Scientific and Technological Literacy is best exhibited when it is embedded in prevailing traditions and cultures and meets people's real needs (Rassool 1999). Consequently, while the United Nations finds that technoliteracy is a universal goal of mounting importance due to global technological transformation, STL programs require that various individuals, cultural groups, and states will formulate the questions through which they gain literacy differently and for diverse reasons (Holbrook 2000).

Oppositional Technoliteracy: Towards Critical Multiple Literacies

> Technical and scientific training need not be inimical to humanistic education as long as science and technology in the revolutionary society are at the service of permanent liberation, of humanization.
> -- Paulo Freire (1972)

As we have seen, technoliteracy should be seen as a site of struggle, as a contested terrain used by the Left, Right, and Center of different nations to promote their own interests, and so those interested in social and ecological justice should look to define and institute their own oppositional forms. Dominant corporate and state powers, as well as conservative and rightist groups, have been making serious use of high-technologies and education to advance their agendas. In the political battles of the future, then, educators (along with citizens everywhere) will need to devise ways to produce and use these technologies to advance a critical oppositional pedagogy that serves the interests of the oppressed. Therefore, in addition to more traditional literacies such as the print literacies of reading and writing[6], as well as other non-digital new literacies (Lankshear and Knobel

[6] We resist that technoliteracy outmodes print literacy. Indeed, in the emergent information-communication technology environment, traditional print literacy takes on increasing importance in the computer-mediated cyberworld as people need to critically scrutinize

2000), we argue that robustly critical forms of media, computer, and multimedia literacies need to be developed as subsets of a larger project of multiple technoliteracies that furthers the ethical reconstruction of technology, literacy, and society in an era of technological revolution.

Critical Media Literacies

With the emergence of a global media culture, technoliteracy is arguably more important than ever, as media essentially are technologies. Recently cultural studies and critical pedagogy have begun to teach us to recognize the ubiquity of media culture in contemporary society, the growing trends toward multicultural education, and the need for a media literacy that addresses the issue of multicultural and social difference (Kellner 1998). Additionally, there is an expanding recognition that media representations help construct our images and understanding of the world and that education must meet the dual challenges of teaching media literacy in a multicultural society and of sensitizing students and publics to the inequities and injustices of a society based on gender, race, and class inequalities and discrimination. Also, critical studies have pointed out the role of mainstream media in exacerbating or diminishing these inequalities, as well as the ways that media education and the production of alternative media can help create a healthy multiculturalism of diversity and strengthened democracy. While significant gains have been made, continual technological change means that those involved in theorizing and practicing media literacy confront some of the most serious difficulties and problems that face us as educators and citizens today.

It should be noted that media culture is itself a form of pedagogy that teaches proper and improper behavior, gender roles, values, and knowledge of the world (Kellner 1995a; b). Yet, people are often not aware that they are being educated and constructed by media culture, as its pedagogy is frequently invisible and subliminal. This situation calls for critical approaches that make us aware of how media construct meanings, influence and educate audiences, and impose their messages and values. A media-literate person, then, is skillful in analyzing media codes and conventions, able to criticize stereotypes, values, and ideologies, and competent to interpret the multiple meanings and messages generated by media texts. Thus, media literacy helps people to use media intelligently, to discriminate and evaluate media content, to critically dissect media forms, and to investigate media effects and uses (see Kellner, 1995a; b).

Traditional literacy approaches attempted to "inoculate" people against the effects of media addiction and manipulation by cultivating high cultured book literacy and by denigrating dominant forms of media and computer culture (see Postman 1985; 1992). In contrast, the media literacy movement attempts to teach students to read, analyze, and decode media texts, in a fashion parallel to the advancement of print literacy. Critical media literacy, as outlined here, goes further still in its call for the analysis of media culture as technologies of social production and struggle, thereby teaching students to be critical of media representations and discourses, as it stresses the importance of learning

---

tremendous amounts of information, putting increasing emphasis on developing reading and writing abilities. Theories of secondary illiteracy, in which new media modes contribute to the complete or partial loss of existing print literacy skills due to lack of practice, demonstrates that new technologies cannot be counted upon to deliver print literacy of their own accord.

to use media technologies as modes of self-expression and social activism wherever appropriate (Kellner 1995a).

Developing critical media literacy and pedagogy also involves perceiving how media like film or video can also be used positively to teach a wide range of topics, like multicultural understanding and education. If, for example,
multicultural education is to champion genuine diversity and expand the curriculum, it is important both for groups excluded from mainstream education to learn about their own heritage and for dominant groups to explore the experiences and voices of minority and excluded groups. Thus, media literacy can promote a more multicultural technoliteracy, conceived as understanding and engaging the heterogeneity of cultures and subcultures that constitute an increasingly global and multicultural world (Courts 1998; Weil 1998).

Critical media literacy not only teaches students to learn from media, to resist media manipulation, and to use media materials in constructive ways, but it is also concerned with developing skills that will help create good citizens and make them more motivated and competent participants in social life. Critical media literacy can be connected with the project of radical democracy as it is concerned to develop technologies that will enhance democratization and participation. In this respect, critical media literacy takes a comprehensive approach that teaches critical attitudes and provides experimental use of media as technologies of social communication and change (Hammer 1995). The technologies of communication are becoming more and more accessible to young people and ordinary citizens, and can be used to promote education, democratic self-expression, and social progress. Technologies that could help produce the end of participatory democracy, by transforming politics into media spectacles and the battle of images, and by turning spectators into cultural zombies, could also be used to help invigorate democratic debate and participation (Kellner 1990; 2003b).

Critical Computer Literacies

To fully participate in a high-tech and global society, people should cultivate new forms of computer literacy in ways that go beyond standard technical notions. Critical computer literacy involves learning how to use computer technologies to do research and gather information, to perceive computer culture as a contested terrain containing texts, spectacles, games, and interactive multimedia, as well as interrogation of the political economy, cultural bias, and environmental effects of computer-related technologies (Park and Pellow 2004; Grossman 2004; Plepys 2002; Heinonen, Jokinen, and Kaivo-oja 2001; Bowers 2000).

The emergent cybercultures can be seen as a discursive and political location in which students, teachers, and citizens can all intervene, engaging in discussion groups and collaborative research projects, creating websites,
producing innovative multimedia for cultural dissemination, and cultivating novel modes of social interaction and learning. Computers can thereby enable people to actively participate in the production of culture, ranging from
dialogue and debate on public issues to the creation and expression of their own cultural forms. Thus, computers and the Internet can provide opportunities for multiple voices, alternative online communities, and enhanced political activism (Kahn & Kellner 2003). However, to take part in this culture requires multiple forms of technoliteracy.

For not only are accelerated skills of print literacy necessary, which are often restricted to the growing elite of students who are privileged to attend adequate and

superior public and private schools, but in fact it demands a critical information literacy as well. Such literacy would require learning how to distinguish between good and bad information, identifying what Burbules & Callister (2000) identify as misinformation, malinformation, messed-up information, and mostly useless information. In this sense, information literacy is closely connected with education itself, with learning where information is found, how to produce knowledge and understanding, and how to critically evaluate and interpret information sources and material. It also raises profound questions of power and knowledge, concerning the definitions of high and low-status knowledge, who gets to produce and valorize various modes of information, whose ideas get circulated and discussed, and whose get marginalized.

Critical Multimedia Literacies

With an ever-developing multimedia cyberculture, beyond popular film and television culture, visual literacy takes on increased importance. On the whole, computer screens are more graphic, multisensory, and interactive than conventional print fields, something that disconcerted many of us when first confronted with the new environments. Icons, windows, mouses, and the various clicking, linking, and interaction involved in computer-mediated hypertext dictate new competencies and a dramatic expansion of literacy within the context of skills.

Visuality is obviously crucial, compelling users to perceptively scrutinize visual fields, perceive and interact with icons and graphics, and use technical devices like a mouse to access the desired material and field. But tactility is also important, as individuals must learn navigational skills of how to proceed from one field and screen to another, how to negotiate hypertexts and links, and how to move from one program to another if one operates, as most now do, in a window-based computer environment. Further, as voice and sound enter multimedia culture, refined hearing also becomes part of the aesthetics and pedagogies of an expanded technoliteracy that should allow for multiple methods of learning (Gardner 1983).

Contemporary multimedia environments necessitate a diversity of types of multisemiotic and multimodal interactions, involving interfacing with word and print material and often images, graphics, as well as audio and video material (Hammer and Kellner 2001). As technological convergence develops apace, individuals will need to combine the skills of critical media literacy with traditional print literacy and new forms of multiple literacies to access, navigate, and participate in multimediated reality. Reading and interpreting print was the appropriate mode of literacy for an age in which the primary source of information was books and tabloids, while critical multimedia literacy entails reading and interpreting a plethora of discourse, images, spectacle, narratives, and the forms and genres of global media culture. Thus, technoliteracy in this conception involves the ability to engage effectively in modes of multimedia communication that include print, speech, visuality, tactility, and sound, within a hybrid field that combines these forms, all of which incorporate skills of interpretation and critique.

Reconstructing Technoliteracy

> We are, indeed, designers of our social futures.
>
> -- New London Group (1996)

Adequately meeting the challenge issued by the concept of technoliteracy raises

questions about the design and reconstruction of technology itself. As Andrew Feenberg has long argued (1991, 1995, 1999), democratizing technology often requires its reconstruction and re-visioning by individuals. "Hackers" have redesigned technological systems, notably starting the largely anti-capitalist Open Source and Free Software movements, and indeed much of the Internet itself has been the result of individuals contributing collective knowledge and making improvements that aid various educational, political, and cultural projects. Of course, there are corporate and technical constraints in that dominant programs and machines impose their rules and abilities upon users, but part of re-visioning technoliteracy requires the very perception and transformation of those limits. Technoliteracy must help teach people to become more ethical producers, as well as consumers, and thus it can help to redesign and reconstruct modern technology towards making it more applicable to people's needs and not just their manufactured desires.

Crucially, alternative technoliteracies must become reflective and critical, aware of the educational, social, and political assumptions involved in the restructuring of education, technology, and society currently under way. In response to the excessive hype concerning new technologies and education, it is important to maintain the critical dimension and to reflect upon the nature and effects of emergent technologies and the pedagogies developed as a response to their challenge. Many advocates of new technologies, however, eschew critique for a more purely affirmative agenda.

For instance, after an excellent discussion of new modes of literacy and the need to rethink education, Gunther Kress argues that we must move from critique to design, beyond a negative deconstruction to more positive construction (1997). But rather than following such modern logic of either/or, critical pedagogues should pursue the logic of both/and, perceiving design and critique, deconstruction and reconstruction, as complementary and supplementary rather than as antithetical choices. Certainly, we need to design alternative pedagogies and curricula for the future, as well as developing improved social and cultural relations, but we need also to criticize misuse, inappropriate use, over-inflated claims, and exclusions and oppressions involved in the introduction of ICTs into education. Moreover, the critical dimension is more than ever necessary as we attempt to develop contemporary approaches to technoliteracy, and design more emancipatory and democratizing technologies. In this process, we must be critically vigilant, practicing critique and self-criticism, putting in question our assumptions, discourses, and practices, as we seek to develop technoliteracies and pedagogies of resistance (Kellner 2003a).

In sum, people should be helped to advance the multiple technoliteracies that will allow them to understand, critique, and transform the oppressive social and cultural conditions in which they live, as they become ecologically-informed, ethical, and transformative subjects as opposed to objects of technological domination and manipulation. This requires producing multiple oppositional literacies for critical thinking, reflection, and the capacity to engage in the creation of discourse, cultural artifacts, and political action amidst widespread technological revolution. Further, as active and engaged subjects arise through social interactions with others, a notion of convivial technologies must come to be a part of the kinds of technoliteracy that a radical reconstruction of education now seeks to cultivate.

We cannot stress it enough: the project of reconstructing technoliteracy must take different forms in different contexts. In almost every cultural and social situation, however, a literacy of critique should be enhanced so that citizens can name the technological system, describe and grasp the technological changes occurring as defining features of the new global order, and learn to experimentally engage in critical and oppositional practices in the interests of democratization and progressive transformation. As part of a truly multicultural order, we need to encourage the growth and flourishing of numerous standpoints (Harding 2004) on technoliteracy, looking out for and legitimizing counter-hegemonic needs, values, and understandings. Such would be to propound multiple technoliteracies "from below" as opposed to the largely functional, economistic, and technocratic technoliteracy "from above" that is favored by many industries and states. Thereby, projects for technoliteracies can allow reconstructive opportunities for a better world to be forged out of the present age of unfolding crisis.

Bibliography

Apple, Michael. (1992). "Is New Technology Part of the Solution or Part of the Problem in Education." John Beynon and Hughie Mackay (eds.), *Technological Literacy and the Curriculum.* London: The Falmer Press, 105-124.

Aronowitz, Stanley. (1985). "Why Should Johnny Read?" *The Village Voice Literary Supplement,* (May).

Besser, Howard. (1993). "Education as Marketplace." In R. Muffoletto and N. Knupfer. *Computers in education: Social, historical, and political perspectives*. New Jersey: Hampton Press.

Best, Steven and D. Kellner. (2001). *The Postmodern Adventure: Science, Technology, and Cultural Studies at the Third Millennium*. New York and London: Guilford Press and Routledge.

Bowers, C. A. (2000). Let Them Eat Data: How Computers Affect Education, Cultural Diversity, and the Prospects of Ecological Sustainability. Athens, GA: University of Georgia Press.

Brundtland, G. H., et al. (1987). Our Common Future: Report of the World Commission on Environment and Development. Oxford: Oxford University Press.

Burbules, N. and Callister, T. (1996). "Knowledge at the crossroads." *Educational Theory.* Vol. 46(1): 23-34.

---. (2000). *Watch IT: the risks and promises of information technology*. Boulder: Westview Press.

Bromley, H. and M. Apple (eds.). (1998). Education/ Technology/Power: Educational Computing as Social Practice. Albany, NY: State University of New York Press.

Castells, Manuel. (1996). The Information Age: Economy, Society and Culture Vol.I: The Rise of the Network Society. Cambridge: MA. Blackwell Publishers.

Cope, B., & Kalantzis, M. (eds.). (2000). *Multiliteracies : Literacy learning and the design of social futures*. New York: Routledge.

Coppola, N. W. (1999). "Greening the technological curriculum: A model for environmental literacy." *Journal of Technology Studies*. Vol. 25(2): 39-46.

Courts, Patrick L.(1998). *Multicultural Literacies: dialect, discourses, and diversity*. New York: Peter Lang.

Dewey, John. (1916). *Democracy and education: An introduction to the philosophy of education*. Carbondale and Edwardsville: Southern Illinois University Press.
Dyrenfurth, M. J. (1991). "Technological literacy synthesized." In M. J. Dyrenfurth & M. R. Kozak (eds.),
Technological literacy. Peoria, IL: Glencoe, McGraw-Hill: 138-186.
Feenberg, Andrew. (1991). *Critical Theory of Technology*. New York: Oxford University Press.
---. (1995). *Alternative Modernity*. Berkeley: University of California Press.
---. (1999). *Questioning Technology*. New York and London: Routledge.
Freire, Paulo. (1972). *Pedagogy of the Oppressed*. New York: Herder & Herder.
Freire, Paulo and D. Macedo. (1987). *Literacy: Reading the Word and the World*. Westport, CT: Bergin & Garvey.
Gardner, Howard. (1983). *Frames of Mind*. New York: Basic Books Inc.
Gore, Albert. (1994). "Remarks Prepared for Delivery." Speech at the International Telecommunications Union (Buenos Aires:). Online at: http://263.aka.org.cn/ Magazine/Aka4/gorestalk.html.
Grossman, Elizabeth. (2004). "High-tech Wasteland." *Orion*. July/August. Online at: http://www.oriononline.org/ pages/om/04-4om/Grossman.html.
Grubb, W. N. (1996). "The new vocationalism - What it is, what it could be." *Phi Delta Kappan, 77*(8): 535-546.
Hammer, Rhonda. (1995). "Strategies for Media Literacy." In Peter McLaren, R. Hammer, D. Sholle and S. Reilly. *Rethinking Media Literacy: a critical pedagogy of representation*. New York: Peter Lang: 225-235.
Hammer, Rhonda & D. Kellner. (2001). "Multimedia pedagogy and multicultural education for the new millennium." *Current Issues in Education*. Vol. 4(2). Online at: http://cie.ed.asu.edu/volume4/number2/.
Harding, Sandra (ed.). (2004). *The Feminist Standpoint Theory Reader: Intellectual and Political Controversies*. New York and London: Routledge.
Hayden, M. (1989). "What is technological literacy?" *Bulletin of Science, Technology and Society*. Vol. *119*: 220-233, STS Press.
Heinonen, S., Jokinen, P. and Kaivo-oja, J. (2001). "The ecological transparency of the information society." *Futures*. Vol. 33: 319-337.
Hickman, Larry. (2001). *Philosophical Tools for Technological Culture*. Bloomington: Indiana University Press.
Holbrook, Jack, A. Mukherjee and V.S. Varma. (eds.) (2000). *Scientific and Technological Literacy for All*. UNESCO and International Council of Associations for Science Education. Delhi, India: Center for Science Education and Communication.
Illich, Ivan. (1973). *Tools for Conviviality*. New York: Harper and Row.
Jegede, Olugbemiro. (2002). "An Integrated ICT-Support for ODL in Nigeria: The Vision, the Mission and the Journey so Far." Paper prepared for the LEARNTEC-UNESCO 2002 Global Forum on Learning Technology. Karlsruhe, Germany.
Jenkins, Edgar W. (1997). "Technological Literacy: Concepts and Constructs." *Journal of Technology Studies. Vol.* 23(1).
Kahn, Richard and D. Kellner. (2003). "Internet Subcultures and Oppositional Politics." David Muggleton (ed.), *The Post-Subcultures Reader*. London: Berg Publishers.
---. (2005). "Oppositional Politics and the Internet: A Critical/Reconstructive Approach."

Cultural Politics, Vol. 1, No. 1. Berg Publishers.
---. (*forthcoming*). "Paulo Freire and Ivan Illich: Technology, Politics, and the Reconstruction of Education." C. Torres (ed.) *Paulo Freire and the Possible Dream*. Urbana, IL: University of Illinois Press.
Kelly, K. (1998). *New Rules for the New Economy*. Fourth Estate, London.
Kellner, Douglas. (1989). *Critical Theory, Marxism and Modernity*. Baltimore, MD: Johns Hopkins University Press.
---. (1995). Media Culture: Identity and Politics Between the Modern and the Postmodern. New York, NY: Routledge.
---. (1998). "Multiple Literacies and Critical Pedagogy in a Multicultural Society." *Educational Theory,* 48: 103--122.
---. (2000). "Globalization and New Social Movements: Lessons for Critical Theory and Pedagogy." Nick Burbules and C.A. Torres (eds.), *Globalization and Education: Critical Perspectives*. New York: Routledge.
---. (2002). "Theorizing Globalization." *Sociological Theory* (November), 20:3, 285-305.
---. (2003a). *Media Spectacle*. London and New York: Routledge.
---. (2003b). *From 9/11 to Terror War: The Dangers of the Bush Legacy*. Lanham, MD: Rowman & Littlefield.
---. (2003c). "Toward a Critical Theory of Education." *Democracy & Nature*, vol. 9, no. 1. Taylor and Francis: 51-64.
---. (2004). "Technological Transformation, Multiple Literacies, and the Re-visioning of Education." *E-Learning*. Volume 1, Number 1.
---. (2005). *Media Spectacle And The Crisis Of Democracy: Terrorism, War, And Election Battles*. Boulder, CO: Paradigm Publishers.
Kovel, Joel. (1983). "Theses on Technocracy." *Telos*. No. 54 (Winter).
Kress, Gunther. (1997). "Visual and Verbal Modes of Representation in Electronically Mediated Communication: the potentials of new forms of text." In I. Snyder (Ed.) *Page to Screen: taking literacy into the electronic era*. Sydney, Australia: Allen & Unwin: 53-79.
Lankshear, C. and M. Knobel. (2000). "Mapping postmodern literacies: A preliminary chart." *The Journal of Literacy and Technology*. Vol.1, No.1, Fall. Online at: http://www.literacyandtechnology.org/v1n1/lk.html.
Lankshear, C. and I. Snyder. (2000). *Teachers and Technoliteracy: Managing Literacy, Technology and Learning in Schools*. Sydney, Australia: Allen & Unwin.
Lewis, T. & C. Gagel. (1992). "Technological literacy: A critical analysis." *Journal of Curriculum Studies*. Vol. 24(2).
Lonsdale, Michele and D. McCurry. (2004). *Literacy in the New Millennium*. Adelaide, Australia: NCVER.
Luke, Carmen. (1997). *Technological Literacy*. Melbourne: National Languages & Literacy Institute. Adult Literacy Network.
---. (2000). "Cyber-schooling and Technological Change: Multiliteracies for New Times" in *Multiliteracies: Literacy, Learning, and the Design of Social Futures*. B. Cope and M. Kalantzis (eds.), Australia: Macmillan, 69--105.
Luke, Allan and C. Luke. (2002). "Adolescence Lost/Childhood Regained: On Early Intervention and the Emergence of the Techno-Subject." *Journal of Early Childhood Literacy*, Vol 1 (1): 91-120.

Marcuse, Herbert. (1965). "Repressive Tolerance." in: Robert Paul Wolff, Barrington Moore, jr., and Herbert Marcuse, *A Critique of Pure Tolerance* (Boston: Beacon Press, 1969), pp. 95-137.

McLaren, Peter, R. Hammer, D. Sholle, and S. Reilly. (1995). *Rethinking Media Literacy: a critical pedagogy of representation*. New York: Peter Lang.

McLuhan, Marshall. (1964). *Understanding Media: The Extensions of Man*. New York: Signet Books.

National Commission on Excellence in Education. (1983). *A Nation at Risk: The Imperative for Educational Reform*. Washington, DC.

National Telecommunications & Information Administration. (2002). *A Nation Online: How Americans are Expanding Their Use of the Internet*. Online at: http://www.ntia.doc.gov/ntiahome/dn/nationonline _020502.htm.

New London Group. (1996). "A Pedagogy of Multiliteracies: designing social futures." *Harvard Educational Review*. Vol. 66: 60-92.

Park, Lisa Sun-Hee and David N. Pellow. (2004). "Racial formation, environmental racism, and the emergence of Silicon Valley." *Ethnicities*. Vol. 4(3): 403-424.

Pearson, Greg and A. Thomas Young. (2002). *Technically Speaking: Why All Americans Need to Know More About Technology*. National Academies Press.

Petrina, S. (2000). "The Politics of Technological Literacy." *International Journal of Technology and Design Education* 10, no. 2: 181-206.

Plepys, Andrius. (2002). "The grey side of ICT." *Environmental Impact Assessment Review*. Vol. 22: 509-23.

Plotnick, E. (1999). Information literacy. ERIC Clearinghouse on Information and Technology, Syracuse University. ED-427777.

Postman, Neil. (1985). *Amusing Ourselves to Death*. New York: Viking-Penguin.

---. (1992). Technopolis: the surrender of culture to technology. New York: Random House.

Power, C. (1987). "Science and technology towards informed citizenship." *Castme Journal*. Vol. 7, 3: 5-18.

Rassool, N. (1999). Literacy for sustainable development in the age of information. London, UK: Multilingual Matters Ltd.

Royal Society. (1985). *The public understanding of science*. London: Royal Society.

Selfe, Cynthia L. (1999). *Technology and Literacy in the Twenty-First Century: The Importance of Paying Attention*. Carbondale, IL: Southern Illinois University Press.

Street, Brian. (1984). *Literacy in theory and practice.* Cambridge, UK: Cambridge University Press.

Suppes, Patrick. (1968). "Computer Technology and the Future of Education." *Phi Delta Kappan*. April: 420-23.

Todd, R. D. (1991). "The natures and challenges of technological literacy." In M. J. Dyrenfurth & M. R. Kozak (eds.) *Technological literacy*. Peoria, IL: Glencoe, McGraw-Hill: 10-27.

Trend, David. (2001). *Welcome to Cyberschool: Education at the Crossroads in the Information Age.* Lanham, Md: Rowman & Littlefield.

United Nations. (1992). *Report of the United Nations Conference on Environment and Development*. Rio de Janeiro, Brazil.

UNESCO. (1994). *The Project 2000+ declaration: The way forward.* Paris, France.

---. (1999). *Science and Technology Education: Philosophy of Project 2000+*. The Association for Science Education. Paris, France.
U.S. Congress. (2001). *No Child Left Behind Act of 2001*. Public Law 107-110. Washington, DC.
U.S. Department of Education. (1996). *Getting America's Students Ready for the 21st Century — Meeting the Technology Literacy Challenge, A Report to the Nation on Technology and Education*. National Education Technology Plan. Washington, D.C.
---. (2004). *Toward a New Golden Age in American Education: How the Internet, the Law, and Today's Students are Revolutionizing Expectations.* National Education Technology Plan. Washington, D.C.
Waetjen, W. (1993). "Technological Literacy Reconsidered." *Journal of Technology Education*. Vol. 4, No. 2.
Wagner, Dan and R. Kozma. (2003). "New Technologies for Literacy and Adult Education: A Global Perspective." Paper for NCAL/OECD International Roundtable. Philadelphia, PN. Online at: http://www.literacy.org/ICTconf/PhilaRT_wagner_kozma_final.pdf.
Wajcman, Judy. (2004). *Technofeminism*. Malden, MA: Polity Press.
Weil, Danny K. (1998). *Toward a Critical Multicultural Literacy*. New York: Peter Lang.
Wells, H.G. (1938). *World Brain*. New York, Doubleday.