In April 2004, the International Reading Association will publish the fifth edition of *Theoretical Models and Processes of Reading* (Robert B. Ruddell and Norman Unrau, editors). The following is a preprint of a chapter from that publication.

Toward a Theory of New Literacies Emerging From the Internet and Other Information and Communication Technologies

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The essence of both reading and reading instruction is change. Reading a book changes us forever as we return from the worlds we inhabit during our reading journeys with new insights about our surroundings and ourselves. Teaching a student to read is also a transforming experience. It opens new windows to the world and creates a lifetime of opportunities. Change defines our work as both literacy educators and researchers — by teaching a student to read, we change the world.

Today, reading, reading instruction, and more broadly conceived notions of literacy and literacy instruction are being defined by change in even more profound ways as new technologies require new literacies to effectively exploit their potentials (Coiro, 2003; Kinzer & Leander, 2003; Lankshear & Knobel, 2003; Leu, 2000a; Smolin & Lawless, 2003). These include technologies such as gaming software (Gee, 2003), video technologies (O'Brien, 2001), technologies that establish communities on the Internet (Chandler-Olcott & Mahar, 2003), search engines (Jansen, Spink, & Saracevic, 2000), webpages, and many more yet to emerge.

Moreover, these new literacies change regularly as technology opens new possibilities for communication and information. We see this happening today as people redefine literacy practices while they communicate on a chatboard associated with a website, talk to one another using a video cam, or participate in virtual reality role-playing games (Cammack, 2002; King & O'Brien, 2002; Kinzer, 2003; Lewis & Fabos, 1999). The ability to linguistically manipulate identity as well as the norms of conversation to fit these new electronic spaces has implications for both the development of language and conceptions of the role of technology (Crystal, 2001).

All of these practices impact our conceptions of literacy and, ultimately, influence the definitions of literacies in classrooms, at home, and at work. As more and more individuals use new technologies to communicate, these linguistic activities come to shape the ways in which we view and use language and literacy. Most important, new literacies, whether intentionally or unintentionally, impact literacy instruction in classrooms (Hagood, Stevens, & Reinking, 2003; Lankshear & Knobel, 2003; Lewis & Finders, 2002).

Consider, for example, the changes experienced by students who graduate from secondary school this year. Their story teaches us an important lesson about our literacy future. Many graduates started their school career with the literacies of paper, pencil, and book technologies but will finish having encountered the literacies demanded by a wide variety of information and communication technologies (ICTs): Web logs (blogs), word processors, video editors, World Wide Web browsers, Web editors, e-mail, spreadsheets, presentation software, instant messaging, plug-ins for Web resources, listservs, bulletin boards, avatars, virtual worlds, and many others. These students experienced new literacies at the end of their schooling unimagined at the beginning. Given the increasingly rapid pace of change in the technologies of literacy, it is likely that students who begin school this year will experience even more profound changes during their own literacy journeys. Moreover, this story will be repeated again and again as new generations of students encounter yet unimagined ICTs as they move through school and develop currently unenvisioned new literacies.

While it is clear that many new literacies are emerging rapidly, we believe the most essential ones for schools to consider cluster around the Internet and allow students to exploit the

extensive ICTs that become available in an online, networked environment. In an information age, we believe it becomes essential to prepare students for these new literacies because they are central to the use of information and the acquisition of knowledge. Traditional definitions of literacy and literacy instruction will be insufficient if we seek to provide students with the futures they deserve.

Precisely what are the new literacies of the Internet and other ICTs? Any realistic analysis of what we know about new literacies from the traditional research literature must recognize that we actually know very little. Far too little research has been conducted in this area for far too long. This is, perhaps, the most troublesome observation that results from any analysis of research in this area (Lankshear & Knobel, 2003; Leu, 2000a).

Another important problem is that we lack a precise definition of what new literacies are. This makes theory development as well as systematic investigation impossible. In order to move forward in this area, we have begun to frame a conception of new literacies around the following definition:

> The new literacies of the Internet and other ICTs include the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional lives. These new literacies allow us to use the Internet and other ICTs to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others.

A more precise definition of these new literacies may never be possible to achieve because their most important characteristic is that they change regularly; as new technologies for information and communication continually appear, still newer literacies emerge (Bruce, 1997a; Leu, 2000a; Reinking, 1998). The continuous nature of these profound changes requires new theories to help us understand them and also to direct the important research agenda that lies ahead. We argue that new theoretical perspectives must emerge from the new literacies engendered by the requirements and possibilities of new technologies.

The purpose of this chapter is to explore promising lines of theoretical work and to show how a New Literacies Perspective, a theoretical perspective that has informed much of our own work, can provide important insights into the important changes taking place to literacy as the Internet and other ICTs enter our world. We begin by considering the social contexts throughout history that have shaped both the function and form of literate behavior. Next, we discuss literacy within today's social context and explain how this has produced new ICTs, such as the Internet, and the new literacies that these technologies demand. Third, we explore several theoretical perspectives that are emerging and argue why we believe a New Literacies Perspective is especially useful to understand changes taking place to the nature of reading as well as more broadly conceived notions of literacy. Then, we identify a list of 10 principles that inform a New Literacies Perspective. We conclude by considering the implications of this perspective for both research and practice.

Literacy Within Social and Historical Contexts

The forms and functions of literacy, as well as literacy instruction itself, are largely determined by the continuously changing social forces at work within any society and the technologies these forces often produce (Boyarin, 1993; Diringer, 1968; Gee, 1996; Illera, 1997; Manguel, 1996; Mathews, 1966; Smith, 1965). Historically, the social forces affecting the nature of literacy have had diverse origins. The need to record business transactions in societies moving out of a subsistence economy, the forces of oppression and resistance, the dissemination of religious dogma, the emergence of democratic institutions, and many other disparate forces all have influenced the nature of literacy in different eras.

Often, we lose sight of these historic roots. We need to remember that social forces and the technologies they often produce define the changing nature of literacy today just as much as they have in the past. Briefly identifying previous historical contexts will remind us of how important it is to understand this point before we explore the changing nature of literacy within our contemporary context.

The manner in which social forces define the nature of literacy can be seen at the beginning of written language, which most believe took place in Sumerian society during the fourth century B.C. As agricultural technologies improved, allowing this civilization to expand, it became necessary to record business transactions and tax records. This social necessity prompted the development of the first writing technology, cuneiform tablets that were used throughout Mesopotamia to initially record economic exchanges and tax obligations (Boyarin, 1993; Diringer, 1968; Manguel, 1996).

In other cultural contexts, literacy became a way to communicate common experiences among the oppressed, often using a special symbolic system. In 11th-century Japan, the women at court developed a separate language system and Lady Murasaki used this to write the first novel, *The Tale of the Genji* (Manguel, 1996; Morris, 1964). The language system she used allowed this novel and other writing to be shared only among the women at court who could understand it.

Responses to oppression also shaped the nature of literacy in Czarist Russia among radical members of society. Revolutionaries developed *samizdat,* a secretive system for the self-publication of texts and literature prohibited by the government. From this clandestine form of writing and reading emerged a set of symbolic representations for revolution and resistance, many of which made their way past unknowing censors into officially published works of literature (Teras, 1994).

At other times, the need to spread religious dogma has shaped the form and function of literacy. In medieval Europe, for example, the Christian church used literacy as a vehicle to enforce a common religion in a world with competing religious viewpoints. A literate priesthood was used to faithfully copy, read, and interpret common religious texts. Holding literacy, the technologies of literacy, and the central texts of Christianity so tightly within a priesthood enabled this religion to survive across enormous distances, cultures, and time, while it also enforced inequities in power.

Forces of resistance inevitably emerged, however, largely due to the belief that individuals, not priests, should be responsible for their own salvation. In postreformation Europe, literacy became much more widespread as Martin Luther argued the need for individuals to read and directly access religious texts on their own. Simultaneous with this resistance, printing technologies and new book literacies emerged to enable this more individual definition of salvation and a more distributed definition of literacy.

The printing of books and the emergence of a more widely distributed literacy posed an important political threat to autocratic governments. In England and her colonies, the royal government carefully restricted printing presses. Until 1695, when the Licensing Act of 1662 expired, printing was confined to London, York, and the universities at Oxford and Cambridge (Ford, 2001). Printing was completely forbidden in the royal colony of Virginia until 1730. As one Governor of Virginia, Sir William Berkeley (1642-1652 and 1660-1677) put it, "But, I thank God, there are no free schools nor printing…for learning has brought disobedience, and heresy, and sects into the world, and printing has divulged them, and libels against the best government. God keep us from both" (Ford, 2001, p. 6).

In the United States and other countries, the development of democracy, based on informed citizens making reasoned decisions at the ballot box, led to an even more widely distributed definition of literacy, one that included debate within a free press. The development of democracy also led to the establishment of public schools charged with developing citizens who were literate, and in their literacy might be thoughtfully informed about important national affairs in which many were expected to participate (Kaestle, Damon-Moore, Stedmen, Tinsley, &

Trollinger, 1993; Mathews, 1966).

It is clear that social contexts profoundly shape the changing nature of literacy. It is also true that social contexts influence the changing nature of literacy instruction. Nila Banton Smith (1965) demonstrated how social forces at work within the United States regularly altered the nature of literacy instruction:

> The story of American reading is a fascinating one to pursue…. It is a story which reflects the changing religious, economic, and political institutions of a growing and progressive country…. This evolutionary progress in reading has been marked by a series of emphases, each of which has been so fundamental in nature as to have controlled, to a large extent, both the method and content of reading instruction during the period of its greatest intensity. (p. 1)

Smith went on to describe different periods of reading instruction and how each was shaped by the most powerful social forces of its time. These included periods during which reading instruction was influenced by religion (1607-1776), nation building and morality (1776-1840), the education of an intelligent citizenry (1840-1880), the view of reading as a cultural asset (1880-1910), the scientific investigation of reading (1910-1935), international conflict (1935-1950), and culminating, in a prescient analysis, with a period of expanding knowledge and technological revolution (1950 to the present).

Throughout history, literacy and literacy instruction have changed regularly as a result of changing social contexts and the technologies they often prompt. Clearly, the social forces in the present context will exert similar changes. Thus, any attempt to develop a theoretical framework around newly emerging technologies and new literacies must begin by exploring the important social forces at work today. Such an exploration provides the foundation for the New Literacies Perspective.

Literacy in Today's Social Context

What are the important social forces at work today that frame the changes to literacy that we are experiencing? We believe these social forces include the following:

- Global economic competition within economies based increasingly on the effective use of information and communication

- The rapid emergence of the Internet as a powerful new technology for information and communication

- Public policy initiatives by governments around the world to ensure higher levels of literacy achievement including the use of the Internet and other ICTs

Global Economic Competition Within Economies Based Increasingly on the Effective Use of Information and Communication

The world of work is undergoing fundamental transformation (Bruce, 1997b; Drucker, 1994; Gilster, 1997; Mikulecky & Kirkley, 1998; The New London Group, 2000). Indeed, it is this social context that prompts many of the changes to ICTs and to literacy that we are experiencing, making the effective use of the Internet a necessary component of the literacy curriculum.

In some historical contexts, the nature of work has been defined by one's access to land, labor, or financial capital. Analyses by Bell (1977), Burton-Jones (1999), Reich (1992), and others indicate this definition has changed fundamentally within nations developing postindustrial economies. Increasingly, it is access to information and the ability to use information effectively that enables individuals to seize life's opportunities. More and more frequently, work is

characterized by the effective use of information to solve important problems within a globally competitive economy. Moreover, as networked, digital technologies provide increasingly greater access to larger amounts of information, the efficient use of information skills in competitive workplace contexts becomes even more important (Gilster, 1997; Harrison & Stephen, 1996).

Because trade barriers are falling and international trade is expanding, many workplaces are undergoing a radical transformation (Bruce, 1997a; Drucker, 1994; Gilster, 1997; Mikulecky & Kirkley, 1998). In a global economy in which competition is more intense because competing organizations are more numerous and markets are more extensive, workplaces must seek more productive ways of performing if they hope to survive. Often, they seek to transform themselves into high-performance workplaces that are more productive and more responsive to the needs of their customers.

Traditionally, industrial-age organizations were organized in a vertical, top-down fashion. Most decisions were made at the highest levels and then communicated to lower levels, thus wasting much of the intellectual capital within an organization by using tight command and control structures. Information-age organizations seeking to achieve greater productivity are organized horizontally, with teams within lower levels of the organization empowered to make important decisions related to their functioning. Members of these teams must quickly identify important problems, locate useful information related to the problems they identify, critically evaluate the information they find, synthesize this information to solve the problems, and then quickly communicate the solutions to others so that everyone within an organization is informed. These high-performance workplaces seek more fully to utilize the intellectual capital among every employee. This change has had a fundamental effect on the nature of literacy within these organizations.

Each element of change that characterizes the workplace today has important implications for the nature of literacy instruction. First, the change to a high-performance workplace requires organizations to place a premium on people who possess effective problem-solving skills. As collaborative teams seek more effective ways of working, they are expected to identify problems important to their unit and seek appropriate solutions. This has important consequences for schools that will need to provide students with greater preparation in identifying important problems and then solving them, often in collaborative situations.

Having identified important problems, members of high-performance workplace teams must then locate useful information related to those problems. Knowing how, when, and where to locate useful information on the Internet, or on an Intranet, will become an increasingly important component of the literacy curriculum, especially because the availability of information resources and search technologies is expanding rapidly, increasing the importance of effective search strategies.

Having acquired information resources, members of high-performance workplace teams must then know how to critically evaluate that information, sorting out accurate information from inaccurate information, essential information from less-essential information, and biased information from unbiased information. These critical literacies and analytic skills also will become increasingly important elements in the literacy curriculum because they are essential to the careful evaluation of any information one obtains, something that is essential in an informational space such as the Internet where anyone may publish anything.

The ability to synthesize information that one has gathered also will become increasingly important because the ability to use information to solve problems is the essential qualification of successful performance in a globally competitive information economy. We will need to pay increasing importance to informational synthesis in schools to support this important skill.

Finally, members of high-performance workplace teams need to rapidly and clearly communicate their solutions to colleagues in other organizational units. A decentralized workplace requires collaboration and communication skills so that the best decisions get made at every level in an organization and so that changes at one level are clearly communicated to other levels. Because each unit is empowered to identify and solve problems, one must keep others informed of

changes that are taking place and negotiate these changes with others who might be affected by them. We need to support the development of effective collaboration and communication skills using new communication technologies if we wish to prepare children for their futures in a world where these skills are so important.

It is not surprising that the Internet and other ICTs have appeared and become such a prominent part of our lives during the transition from an industrial to a postindustrial society. These new information and communication tools allow us to identify important problems, quickly gather information, critically evaluate the information we locate, synthesize that information into a solution, and then communicate the solution to others. The new literacies required to effectively use ICTs to accomplish these functions are central to success in an information age.

It is important, however, to recognize that new literacies do not simply create more productive workers and workplaces. Just as important, the new literacies of the Internet and other ICTs provide individuals with opportunities to make their personal lives more productive and fulfilling. This might happen while refinancing a home, selecting a university, advocating for social justice, purchasing books, or any one of hundreds of other tasks important to daily life. In addition, we are beginning to see that the new literacies of the Internet and other ICTs permit greater civic engagement in democratic institutions. Increasingly, national and local politics are changing as more citizens discover important information about candidates, participate online in campaign efforts, organize online communities to support various political agendas, and communicate more frequently with their representatives via e-mail. Expertise in the new literacies of the Internet and other ICTs helps individuals have more satisfying personal lives, more engaged civic lives, as well as more productive professional lives.

The Rapid Emergence of the Internet as a Powerful New Technology for Information and Communication

The appearance of the Internet is not a spontaneous, arbitrary event. It has appeared and become a central part of our lives because the nature of the workplace and other social institutions is changing.

In the workplace, survey data from the United States show recent rapid increases in Internet use, revealing changes taking place from the restructuring process described in the previous section. In just one year (August 2000 to September 2001), use of the Internet at work among all employed adults 25 years of age and older increased by nearly 60%, from 26.1% of the workforce to 41.7% (U.S. Department of Commerce, 2002). If this rate of increase continues, nearly everyone in the workforce will be using the Internet at work within just a few years. Currently, workers in positions with the highest levels of education report the highest levels of Internet use in the United States. In managerial positions with some professional specialty, 80.5% of workers report using the Internet. But even in technical, sales, and administrative support positions, 70.5% of workers report using the Internet (U.S. Department of Commerce, 2002). Clearly the Internet is rapidly becoming central to full participation in the workplace.

Statistics on Internet usage at home in the United States parallel these changes in the workplace. Nearly 60% of all households report that they had Internet access in 2002. Among those who had not previously used the Internet, 47% report that they are somewhat likely or very likely to go online during 2003 (Lebo, 2003). Moreover, the percentage of U.S. households with broadband Internet access has been doubling each year from 1998 to 2001, an adoption rate in households exceeding that of any previous technology including telephones, color televisions, videocassette recorders, cellular phones, and pagers (U.S. Department of Commerce, 2002). Most interesting, perhaps, is that Internet users report an increase in time they spend on the Internet and a decrease in the time they spend viewing television (Lebo, 2003). Internet users report watching about 10% fewer hours of television per week in 2002 (11.2 hours per week) compared to 2001 (12.3 hours per week). This pattern also holds true for U.S. children: Nearly 33% of children reported in 2002 that they are viewing less television than before they started using the Internet; this frequency is up nearly 50% from just one year earlier (Lebo, 2003).

The Internet also is appearing in school classrooms in the United States and other countries at a rate that parallels its appearance in the workplace and at home. In only eight years (1994 to 2002), the percentage of classrooms in the United States possessing at least one computer with Internet access has gone from 3% to 92% (National Center for Education Statistics [NCES], 2003a). This is an adoption rate that is unprecedented in schools for any previous technology including televisions, radios, telephones, videocassette recorders, and even books. The availability of Internet access has had a demonstrated impact on students. In 2001, 94% of children ages 12-17 who had Internet access said that they used the Internet for school-related research (Lenhart, Simon, & Graziano, 2001).

The quality of Internet access in schools has also undergone a rapid transformation. In 1996, three quarters of U.S. public schools with Internet connections reported using phone modem access (Heaviside, Riggins, & Farris, 1997), while in 2002, 94% of schools reported having broadband access (NCES, 2003a), permitting faster access to richer, more memory intensive media. The rate at which schools have moved from phone modem access to broadband access in the United States is even faster than this same migration in homes (cf. Lebo, 2003).

Thus, it is clear that the Internet is rapidly finding its way to a central location in the workplace as well as in home and school contexts. We believe that the appearance of the Internet in the workplace as well as in home and school contexts is one of the most powerful social revolutions taking place today. At the heart of this revolution are the new literacy skills and strategies demanded by the Internet and other ICTs.

Public Policy Initiatives by Governments Around the World to Ensure Higher Levels of Literacy Achievement

Governments around the world are keenly aware of the consequences of global economic competition for their citizens. They have responded by implementing public policies to raise literacy achievement in an attempt to better prepare their children for the challenges that lie ahead. Simultaneously, they have responded with initiatives that provide new ICTs resources to schools in an effort to prepare children for the new literacies of their future. These simultaneous steps by nations around the world are the beginning of a convergence we anticipate for literacy instruction with networked technologies for information and communication (Leu & Kinzer, 2000).

In the United Kingdom, for example, education has been identified as a top priority of the Labour government. The first white paper of this government, *Excellence in Schools,* explains in detail how higher standards for literacy are to be developed and achieved in England, Wales, and Northern Ireland (U.K. Secretary of State for Education and Skills, 1997). The reason for this is clearly linked to global competition in an information age and the implications of a restructured economy: "We are talking about investing in the human capital in the age of knowledge. To compete in a global economy…we will have to unlock the potential of every young person" (p. 3).

The U.K. Department for Education and Skills has published other papers such as this at "The Standards Site" (www.standards.dfee.gov.uk). Both the national standards and the new national curriculum have included ICTs for the first time (U.K. Department for Education and Skills, 1998). Finally, a National Grid for Learning (www.ngfl.gov.uk) was launched in 1998 to provide an online national portal for teacher and student learning.

Similar policy initiatives are taking place in Finland, one of the first nations to begin this work. The Finnish government appointed an expert committee in 1994 to prepare a national strategy for education, training, and research in an information society. This report, *Education, Training and Research in the Information Society: A National Strategy* (Finland Ministry of Education, 1995), outlines the important role the educational system can play in helping Finland to compete in a global information economy. The report served as the impetus for a number of initiatives from the Ministry of Education, including a three-year program launched in 1996 to teach students effective use of ICTs in schools. This program included developing new teaching methods for the use of ICTs, connecting all schools to the Internet before the year 2000, and

providing new computers to schools. Most important, the program also provides every teacher with five weeks of paid release time for professional development in the instructional use of new information technologies (Finland Ministry of Education, 1998; R. Svedlin, personal communication, January 8, 1998).

Ireland, like many other nations, also launched two policy initiatives: a National Reading Initiative and a Schools IT 2000 initiative. The National Reading Initiative included the appointment of a national coordinator, provision for remedial services in every school, a tripling of adult literacy funding, increased funding for remedial teachers, and a program of development for literacy-related software (Ireland Department of Education and Science, 1998).

The Schools IT 2000 initiative (Ireland Department of Education and Science, 1998) was implemented because "knowledge and familiarity with new technologies will be an important dimension of employability in the information society" (Ireland Department of Education and Science, 1998). Schools IT 2000 encompassed a number of policy initiatives intended to prepare children for a competitive, global, information economy. These included (a) a Technology Integration Initiative to provide more than 15,000 computers and Internet connections in 1998 with additional funds available during subsequent years; (b) a Teacher Skills Initiative to provide training in ICTs for more than 8,000 teachers; (c) a Schools Support Initiative to develop ScoilNet (www.scoilnet.ie), an Internet portal site to provide information and support for educators; and (d) a School Integration Project to provide funding for at least 40 model schools that will demonstrate the effective use of ICTs in the classroom.

Important policy initiatives also are underway in Australia. In April 1999, the federal government approved *The Adelaide Declaration on National Goals for Schooling in the Twenty-First Century* (Australia Department of Education, Science and Training, 2004), which included an emphasis on both literacy and IT. In particular, the goals noted that "When students leave school, they should…be confident, creative and productive users of new technologies, particularly information and communication technologies." Moreover, the federal government has developed *A Strategic Framework for the Information Economy: Identifying Priorities for Action* (Australia National Office for the Information Economy, 1999), which outlines a national strategy and 10 action priorities for becoming more competitive in a global information economy. The second priority focuses on the role of schools in preparing children in information technology: "Deliver the education and skills Australians need to participate in the information economy."

Finally, the federal government along with commonwealth, state, and territory education departments has developed an online Internet portal, the Education Network Australia (www.edna.edu.au). This extensive resource provides a range of information resources for children, teachers, professors, researchers, and policymakers.

New Zealand is also beginning public policy initiatives to raise literacy achievement and to integrate ICTs into the curriculum. At the end of 1998, the government announced that it intended to develop a National Literacy and Numeracy Strategy to enable every 9-year-old to become proficient in reading, writing, and mathematics by 2005 (Literacy Strategy Underway, 1999). As part of this effort, the government appointed a National Literacy Taskforce to assist in developing this strategy. In addition to the need to be competitive in the global economy, the impetus for this is the need to close the gap between good and poor readers (Literacy Strategy Underway).

Simultaneous with these initiatives in literacy education, the New Zealand national government released a policy paper titled *Interactive Education: An Information and Communication Technologies (ICTs) Strategy for Schools* (New Zealand Ministry of Education, 1998) which describes strategies for supporting the use of ICTs in the nation's schools. This document defines the focus for national initiatives in ICTs: building infrastructure and improving the capability of schools to use ICTs effectively in the curriculum. It describes several new initiatives the national government took in 1999: developing an online portal site for schools, teachers, and children (*Te Kete Ipurangi,* available at www.tki.org.nz/e/tki); providing support for professional development so schools can plan for and implement the use of ICTs more effectively; and supporting model ICTs professional development schools. The reason for these initiatives again

was related to global economic competition: "New Zealand schools aim to create a learning environment that enables students to develop the attitudes, knowledge, understandings, and skills to enable them...to succeed in the modern competitive economy" (New Zealand Ministry of Education, 1998, Introduction).

The United States has a long history of state and local control over educational policies and a recent past characterized by intense partisanship at the federal level over educational issues. As a result, national policy initiatives have been difficult to implement in education. Prior to 2002, most of the public policy initiatives for raising literacy achievement took place at the state level. Many states established standards or benchmarks, often in conjunction with new statewide assessment instruments. Many states also initiated polices to infuse more IT and ICTs in the classroom.

At the federal level, educational policy initiatives had been more diffuse in origin, and many were implemented only after bitter partisan debates. Nevertheless, several important initiatives at the federal level have focused on literacy issues. These initiatives produced legislation such as The Reading Excellence Act, the appointment of a National Reading Panel, and the development of Standards for the English Language Arts (International Reading Association [IRA] & National Council of Teachers of English [NCTE],1996). Each of these initiatives, designed to improve reading achievement, was marked by substantial controversy. The controversy has continued with the passage of the No Child Left Behind Act in 2002.

The No Child Left Behind Act enacts an extensive list of public policy initiatives, many of which are also designed to increase student achievement in reading. These provisions include several requirements: that all students are proficient in reading and math within 12 years; that assessment in both reading and math be conducted annually for all students in grades 3-8 and be conducted at least once in grades 10-12; that reading programs be funded only if they are based on scientifically based reading research; and that all teachers be highly qualified, with state certification.

Similar to other nations, this major policy initiative in reading also contains a technology component. Title II, Section D, of the No Child Left Behind Act is devoted to technology with the stated goal, "To assist every student in crossing the digital divide by ensuring that every student is 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." In order to promote the goals of this section, the U.S. federal government plans to provide $1 million each year, most of which will go for state and local technology grants. States must provide a long-range plan for implementing this initiative, and all local units must devote a minimum of 25% of the funds to professional development in the instructional use of the Internet and other ICTs. In addition, the Secretary of Education is charged with developing a national educational technology plan.

In addition to the No Child Left Behind Act, a major policy initiative has been the establishment of the Universal Service Support Mechanism for Schools and Libraries, a policy initiative known informally as the "E-rate program." This program is funded by Congress under the Telecommunications Act of 1996 and is administered by the Schools and Libraries Division (SLD) of the Universal Service Administrative Company (www.sl.universalservice.org), a nonprofit organization established by the Federal Communications Commission (FCC) for this purpose. Starting in 1998, the program began to annually distribute up to $2.25 billion in financial support to schools and libraries for Internet access based on indicators of financial need. This program has contributed in important ways to the rapid infusion of Internet-connected computers within the K-12 classrooms of the United States.

In summary, many nations around the world, aware of the need to prepare students for the challenges of a competitive global economy, are developing public policy initiatives to raise literacy standards and infuse ICTs into the curriculum. While each nation approaches the issue in its own fashion, what is striking is the common effort in this direction. Especially salient is the federal response from those nations, like Australia and the United States, with a long tradition of local control and little previous history of federal intervention. Even these countries are

beginning to develop important national initiatives to raise literacy levels and prepare children in the use of ICTs.

The Importance of an Expanded Definition of Literacy: Emerging Theoretical Perspectives[1]

We have seen how three important social forces in today's world are shaping both the forms and functions of literacy:

1. Global economic competition within economies based increasingly on the effective use of information and communication

2. The rapid emergence of the Internet as a powerful new technology for information and communication

3. Public policy initiatives by governments around the world to ensure higher levels of literacy achievement, including the use of the Internet and other ICTs

It is clear that the nature of literacy is changing rapidly as new ICTs appear, requiring new literacies to fully exploit their potential in what Reinking (1998) has called our "post-typographic" world. These changes make it increasingly impossible to function in the worlds of research, theory, and practice if we define literacy in ways that ignore the reality of the new literacies of the Internet and other ICTs. Questions and issues about types of texts, types of literacies, assessment, curriculum, and teacher education, and how these are impacted by present and emerging technologies, must be addressed if we are to shape theories and pedagogies of literacy that dynamically respond to social and technological change.

Yet to address these issues in a cogent manner, we must begin to develop an adequate definition of what it means to be literate. To develop such a definition, one must ask whether *literacy* as a term presupposes print, whether it presupposes text. Does literacy mean comprehension of print or comprehension of a message that has permanence in ways that a nonrecorded oral message does not? Does reading children's literature presuppose a printed children's book, or can children's literature exist on a CD-ROM or website? Does text presuppose only print, or does it include all aspects in an author's toolbox, which allows meaning to be preserved for later reading and response by an audience?

In addition, definitions and theories of literacy also must consider the rapid changes we are experiencing today as new ICTs regularly emerge. We have argued that the definition of literacy has always changed over historical periods but that it is changing today at a pace we have never before experienced as new technologies for information and communication appear rapidly and continuously (Leu, 2000a; Leu & Kinzer, 2000). Literacy, therefore, may be thought of as a moving target, continually changing its meaning depending on what society expects literate individuals to do. As societal expectations for literacy change, and as the demands on literate functions in a society change, so too must definitions of literacy change to reflect this moving target.

Current definitions of literacy have moved well beyond earlier definitions of literacy as the ability to sound out words and/or copy accurately what is dictated. Definitions of reading, for example, have moved far beyond Flesch's (1955, 1981) views that "[we should teach the child] letter-by-letter and sound-by-sound until he knows it—and when he knows it, he knows how to read" (1955, p. 121) and "learning to read is like learning to drive a car…. The child learns the mechanics of reading, and when he's through, he can read" (1981, p. 3). Definitions by Dechant (1982), Goodman (1976), Rumelhart (1994; see #41 this volume), and others include one's interaction between the text and the reader and include comprehension of the message in addition to decoding the printed page. These authors recognized that the ability to communicate, to present one's message, and to understand and evaluate another's message is part of reading, and that an interaction and transaction into one's experiences as well as personal response and meaning-making is part of the goal for literacy instruction (Harste, 1990; Rosenblatt, 1994, see

#48 this volume; Shanahan, 1990). Yet all these definitions come from a perspective of print and owe their historical roots and conceptions of literacy to a largely print-based world.

Of course, these definitions can be applied to literacy in technological environments to the extent that the symbol systems available to readers and writers when the definitions were conceptualized also exist in electronic environments. However, to the extent that there are additional demands and capabilities of literacy in electronic environments beyond those available at the times respective definitions were conceptualized, current definitions may be less applicable. And, perhaps, the greatest shortcomings of current definitions can be seen in the requirements of interactions between traditionally available literacy resources and new ones, and in the demands on readers and writers that were previously not required for authorship, comprehension, and response to occur. We argue that, as the medium of the message changes, comprehension processes, decoding processes, and what "counts" as literacy activities must change to reflect readers' and authors' present-day strategies for comprehension and response.

Clearly, definitions of literacy must change to include electronic environments. In some ways, however, incorporating technology into definitions of literacy becomes less an argument about whether or not such changes are needed or are effective and more a recognition that schools must incorporate technology or be viewed as out of touch or even irrelevant (see, e.g., Hagood, Stevens, & Reinking, 2003; Lewis & Finders, 2002). Even though many are calling for more research on the efficacy of technology in learning, there is increasing recognition that technology is here to stay; the demand from businesses, parents, and society at large is such that technology will continue to appear in schools even before research outcomes are known.

In sum, the significance of the increasing availability of technology within and beyond schools relates to their situated use in literacy practice, and perhaps relates just as much to the symbolic capital (Bourdieu, 1991) of the technologies in relation to the social spaces of schooling (Bromley & Apple, 1998; Bruce, 1997a). Technology availability in schools both changes literate signifying practices and signifies change in and of itself. The material and ideological meanings of the computer, as with any tool (Cole, 1996), are deeply intertwined. While this double relation of meaning is true across the subject areas of schooling, it may be particularly true for language arts given the significant construction of a discourse on *technological* knowledge as a form of literacy. In this sense, *literacy* might index a very broad range of knowledge and practice (e.g., having technical skill across programs and platforms, knowing how to install and upgrade software) with developing technologies.

Within such a web of practice and representation, schools and districts lacking technology could well be imagined as only "partially literate" spaces. This, of course, is not an argument for the proliferation of technology in schooling. Rather, it is an argument that, in many ways, the meaning of schooled literacy has already been (and will continue to be) articulated with the availability and meaning of technology. As Cammack (2003) points out in her review of Alvermann's (2002) edited volume, "differences in technology use and perceptions of value between teachers and students can effectively act to block change in the integration and use of technology in literacy pedagogy."

Definitions of literacy must move beyond being located in only paper-printed media. Children's literature cannot be limited only to the pages in a paper-based book of printed pages, but must include books in electronic formats as well. The added information and capabilities that electronic formats provide for authors and readers necessitate an expanded view of literacy, what it means to be literate, and what it means to be a teacher (and learner) in the language arts.

Consider, for example, that "decoding" in a print context involves decoding the alphabetic characters as well as any pictures, charts, maps, and graphs that are included on the page. In this sense, the decoding and interpretation of graphics and other forms of media as literacy practice is certainly not a new development, and over the last decade or so researchers have been giving increasing attention to the significance of images, television, drama, and other forms of media in the literate lives of children (Alvermann, Hinchman, Moore, Phelps, & Waff, 1998; Dyson, 1999; Flood & Lapp, 1995). Such work provides an important research base from

which to analyze literacy practices in the multimedia environment of the Internet.

At the same time, the nature and relationships of Internet multimedia also pose unique problems that the study of offline multimedia forms cannot address adequately. For example, forms of decoding are developing that were either relatively minor or simply not possible offline. In an electronic environment, decoding for comprehension includes decoding the strategic use of color; various clues that indicate hyperlinked texts and graphics; the possible actions of meaning-bearing icons and animations; and pictures, maps, charts, and graphs that are not static, but that can change to address questions that an interactive reader can pose to informational text during the reading act. Although definitions of literacy still must include concepts of composition, decoding, comprehension, and response, in order to understand how each of these definitional factors play out in electronic environments we must take into account current uses as indicators of current definitions of literacy.

With personal computers' and the Internet's graphical interfaces, it is no longer possible to position the print text as the focal text in all instances, with images serving only a supporting role in meaning construction. As many webpages are overwhelmingly an assemblage of images, understanding reading across these images significantly decenters print-based reading (Flood & Lapp, 1995). Hypermedia reading practices have at least as much to do with the multiple relations between images as they do with the paths among segments of print text. Importantly, the nature of images also permits writers and readers to link them in ways other than paper-based texts. For instance, while typically a term or phrase of text is linked in linear sequence, an image may be divided into an "image map" in which diverse topological parts of the image are linked to other various images, text, video, or media objects. Running a mouse pointer over an image, for example, often "pops up" text without the mouse being clicked, or causes expansion of an image or graphic. Part of a pie chart might expand with new information when the pointer is moved over its slices, yet no overt clue exists that this would occur, presenting a serendipitous and differential experience across readers who might or might not have moved the mouse pointer over the image.

Perhaps more significant, changing definitions must acknowledge the expanded presence of multimedia, which has led to a proliferation of new combinations of authoring (e.g., voice-annotated websites, video clips with hypertextual analysis). Lemke (1998), from a semiotic perspective, argues convincingly that a central problem is that meanings are not fixed and additive, but multiplicative. That is, in the electronic environment what must be interpreted is not a complementary relation of separately developed texts but the expansive signification of an entire sign system. The literacies necessary to understand multiple, interdependent meanings index the need for complex understandings of literacy "toolkits" (Gee, 1990; Wertsch, 1991) for interpreting and producing meaning in hypermedia that includes but extends traditional texts.

Despite all these changes, our understanding of the new literacies required by ICTs is not well advanced. No single theoretical perspective has yet to explain the full range of the changes to literacy brought about by the Internet and other ICTs. Nevertheless, several useful perspectives are beginning to evolve from various quarters. These include perspectives that focus on critical literacies (Luke, 1997; Muspratt, Luke, & Freebody, 1998), multiliteracies (The New London Group, 2000), media literacy (Tyner, 1998), and others that provide us with insights about the new literacies of ICTs.

Some, for example, have argued that a literacy curriculum during an age of information needs to include new, critical literacies that enable children to adequately evaluate messages from individuals and corporations that shape the information they provide (Muspratt et al., 1998). These authors argue that it is impossible to discuss literacy without considering who is using it and for what purposes. They describe the essential need to understand the stance of the person producing a message, the motive behind the message, and the need to critically evaluate these messages. They foreground the important need to develop critical literacies as an essential element of any instructional program because new media forms, globalization, and economic pressures engender messages that increasingly attempt to persuade individuals to act in ways beneficial to an economic or political unit but not necessarily beneficial to the individual. During an age of information, any theoretical perspective that seeks to capture the changes taking place to literacy must include these essential critical literacies. As the Internet quickly becomes both

an important source for information and an important commercial and political context, critical literacies become even more important to our lives.

A second heuristic that is useful comes from the work of The New London Group (2000). Emerging from sociolinguistic traditions, the group uses the construct *multiliteracies* to capture changes taking place in two dimensions central to literacy: (1) the multiple modalities of communication in a world where many new communication technologies have appeared and (2) the growing diversity of culture and language within an increasingly global community. Instead of defining literacy as a unitary construct, this group recognizes the inherent diversity that constructs literacy in a world defined by new technologies of communication and new cultural and linguistic contexts that become more visible with globalization. Within this type of theoretical framework, one might view reading, writing, and communication on the Internet as including a set of multiliteracies, emerging as individuals from different cultural contexts encounter one another within different communication technologies.

Still others (Silverblatt, Ferry, & Finan, 1999; Tyner, 1998) take a media literacy perspective, which focuses on the new literacies required from new media forms. Media literacy perspectives often are closely aligned with critical literacy perspectives, though they focus more on media forms beyond text such as video and the images that often drive a culture. Like those who take a critical literacy perspective, proponents of a media literacy perspective stress the importance of analyzing an author's stance and motives as well as the need for a critical evaluation of the message itself. This perspective is important to include when considering literacy within Internet technologies because these technologies make possible a panoply of media forms within a single message, thus increasing the importance of understanding how each may be used by an author to shape a reader's interpretation. And, because locations on the Internet often are populated with commercial, political, and economic motives, it becomes essential to be able to carefully evaluate these while gathering information (Kinzer & Leander, 2003).

Other theoretical orientations, too, are possible when considering new literacies appearing on the Internet. These include feminist perspectives (Hawisher & Selfe, 1999), perspectives that draw from postmodernist interpretations of popular culture (Alvermann, Moon, & Hagood, 1999), or perspectives that come from work in cultural transformations (Warschauer, 1999). Each has important insights to contribute to understanding the changes that are taking place.

Although each of these perspectives provides essential insights, we believe they are limited for at least two reasons. First, they fail to place the Internet and other ICTs at the center of their perspective. Instead of emerging from the new literacies of the Internet and other ICTs, these theoretical perspectives have evolved from other contexts and have then been applied to the ICTs landscape. We believe the new literacies of the Internet, because they are more encompassing and because they change more rapidly and in more profound ways than traditional print literacies, require their own theoretical framework in order to adequately understand them and the role they should play in a literacy curriculum.

A second limitation also exists. Other theoretical orientations frequently suffer from a narrower theoretical grounding, often because each has emerged from a more limited tradition of inquiry. For example, while a multiliteracies perspective is a most useful one, its sociolinguistic grounding somewhat limits its ability to predict any of the more cognitive and ontological aspects of new literacies that students must develop in order to become literate with the Internet and other ICTs (Lankshear & Knobel, 2003). We believe that any theory must bring multiple perspectives (Labbo & Reinking, 1999) to bear on framing the totality of the new literacies emerging from the Internet and other ICTs if it is to be useful in informing the complex teaching and learning issues within school contexts.

In short, we believe that a theoretical framework for the new literacies of the Internet and other ICTs needs to be grounded in these technologies themselves, taking advantage of the insights that a variety of different perspectives might bring to understanding the complete picture of the new literacies emerging from these technologies.

Identifying Central Principles of New Literacies Emerging From the Internet and Other ICTs

Although it is too early to define a comprehensive theory of new literacies emerging from these technologies, we are convinced that it is time to begin this process by identifying the central principles on which this theory should be built. Our work is pointing us to these principles of a New Literacies Perspective:

1. The Internet and other ICTs are central technologies for literacy within a global community in an information age.

2. The Internet and other ICTs require new literacies to fully access their potential.

3. New literacies are deictic.

4. The relationship between literacy and technology is transactional.

5. New literacies are multiple in nature.

6. Critical literacies are central to the new literacies.

7. New forms of strategic knowledge are central to the new literacies.

8. Speed counts in important ways within the new literacies.

9. Learning often is socially constructed within new literacies.

10 Teachers become more important, though their role changes, within new literacy classrooms.

The Internet and Other ICTs Are Central Technologies for Literacy Within a Global Community in an Information Age

From a sociolinguistic perspective, Gee (1996) and The New London Group (2000) have argued that literacy is embedded in and develops out of the social practices of a culture. We agree and, from a historical perspective, have demonstrated how different literacies have emerged from different social contexts and the technologies they often prompt.

For the past 500 years, literacy has emerged from a variety of social contexts but has been shaped largely by the technologies of the book and the printing press. Today, both the social context and the technologies of our age are rapidly changing. We believe the Internet and other ICTs are quickly becoming the central technologies of literacy for a global community in an information age. As a result, these technologies are quickly defining the new literacies that will increasingly be a part of our future. Literacy theory, research, and practice must begin to recognize this important fact.

Looking briefly at how reading comprehension takes place on the Internet will illustrate how we need to rethink our assumptions about literacy. Traditionally, reading comprehension has often been defined by the construction of meaning from a fixed body of text. On the Internet, reading comprehension takes on a very different and broader definition. New skills and strategies are required in this context to successfully comprehend information such as how to search for appropriate information; how to comprehend search engine results; how to make correct inferences about information that will be found at any hyperlink; how to determine the extent to which authors "shape" information presented on a webpage; how to coordinate and synthesize vast amounts of information, presented in multiple media formats, from a nearly unlimited set of sources; and how to know which informational elements require attention and which ones may be ignored. Perhaps we can best recognize this fundamentally different conception of reading

comprehension when we understand that two students, with an identical goal, will construct meaning differently, not only because they bring different background knowledge to the task but also because they will use very different search strategies, follow very different informational paths, read very different sets of information, draw very different critical conclusions about what they have read, and attend to very different informational elements. Reading comprehension has a very different meaning on the Internet (Coiro, 2003).

The Internet and Other ICTs Require New Literacies to Fully Access Their Potential

New literacies include the skills, strategies, and disposition that allow us to use the Internet and other ICTs effectively to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others. We encounter new literacies nearly every time we try to read, write, and communicate with the Internet and other ICTs. Examples of new literacies include

- using a search engine effectively to locate information;

- evaluating the accuracy and utility of information that is located on a webpage in relation to one's purpose;

- using a word processor effectively, including using functions such as checking spelling accuracy, inserting graphics, and formatting text;

- participating effectively in bulletin board or listserv discussions to get needed information;

- knowing how to use e-mail to communicate effectively; and

- inferring correctly the information that may be found at a hyperlink on a webpage.

It is essential, however, to keep in mind that new literacies, such as these, almost always build on foundational literacies rather than replace them. Foundational literacies include those traditional elements of literacy that have defined almost all our previous efforts in both research and practice. These include skill sets such as phonemic awareness, word recognition, decoding knowledge, vocabulary knowledge, comprehension, inferential reasoning, the writing process, spelling, response to literature, and others required for the literacies of the book and other printed material. Foundational literacies will continue to be important within the new literacies of the Internet and other ICTs. In fact, it could be argued that they will become even more essential because reading and writing become more important in an information age. While foundational literacies become more important, they also will be insufficient if one is to fully utilize the Internet and other ICTs (Coiro, 2003; IRA, 2002; Leu, 2000b; RAND Reading Study Group, 2002; Spires & Estes, 2002; Sutherland-Smith, 2002). Reading, writing, and communication will assume new forms as text is combined with new media resources and linked within complex information networks requiring new literacies for their effective use.

New Literacies Are Deictic

Leu (1997a, 2000a) and Leu and Kinzer (2000) have argued that we are entering a period of literacy as technological deixis. During this period, the forms and functions of literacy change rapidly as new technologies for information and communication emerge and as individuals construct new envisionments for their use.

The term *deixis* (dike-sis) is a word used by linguists and others (Fillmore, 1972; Murphy, 1986) for words such as *now, today, here, there, go,* and *come.* These are words whose meanings change quickly depending on the time or space in which they are uttered. If we say "now" as we write this draft, it means our current moment during the spring of 2003. If you say "now" when you encounter this example, it means the moment in time when you read these lines. While to Gertrude Stein "A rose is a rose, is a rose," *now* is not *now,* is not *now.* Rather, its meaning depends on the temporal context when it is uttered or written.

Literacy also is deictic (dike-tic). We have seen how both the forms and functions of literacy have changed regularly over time, but because technological change happened slowly, the changes to literacy occurred over extended historical periods. Today, technological change happens so rapidly that the changes to literacy are limited not by technology but rather by our ability to adapt and acquire the new literacies that emerge. Deixis is a defining quality of the new literacies of the Internet and other ICTs. This will continue into the future but at a much faster pace as new technologies repeatedly appear, requiring new skills and new strategies for their effective use. As literacy increasingly becomes deictic, the changing constructions of literacy within new technologies will require all of us to keep up with these changes and to prepare students for a vastly different conception of what it means to become literate.

There are three sources for the deictic nature of literacy: (1) transformations of literacy because of technological change, (2) envisionments of new literacy potentials within new technologies, and (3) the use of increasingly efficient technologies of communication that rapidly spread new literacies. Each source contributes to the fundamental changes taking place in the nature of literacy.

The rapid transformations in the nature of literacy caused by technological change are a primary source for the deictic nature of literacy. New technologies regularly and repeatedly transform previous literacies, regularly redefining what it means to become literate. Consider, for example, the new writing skills required to effectively use a word processor like Microsoft Word. Each time one upgrades to a new version (Word 6, Word 2001, Word 2003, etc.) one must develop new composing and communication skills to take full advantage of the new potentials within each new version. While one might have needed the ability to save documents in different formats in an early version of this program, later versions require additional composing skills such as inserting photographic images from one's photo files or editing a graphic image that is placed within a document. Subsequent generations of this single program will require even newer literacies as new technologies generate new communication and information potentials.

The deictic nature of literacy also is caused by the envisionments we construct as we use new technologies for literate acts. Individuals who use new technologies often envision new ways of using them and, in their envisionments, change the nature of literacy (Leu, Karchmer, & Leu, 1999). Envisionments take place when individuals imagine new possibilities for literacy and learning, transform existing technologies to construct this vision, and then share their work with others. This happens regularly within technologies that permit users to create new visions for their use, something that defines the Internet and most other ICTs.

Consider a person who wishes to send a specially designed and formatted message via e-mail, but she has an e-mail program containing very limited design and format tools. This person might think to use a word processor with more powerful design tools to compose the message, knowing that she could then paste the formatted message into the e-mail message window. Thus, a word processor can be transformed into a tool for composing e-mail messages, a purpose for which it was not designed, but a function it fills admirably. This potential only comes to life when a person envisions a new function for a technology and enacts this envisionment. In essence, we can say that she envisioned how to repurpose a technology for a new and different function. Envisionments such as this happen regularly as individuals encounter new problems and seek solutions in new and creative uses of existing technologies. They contribute to the deictic nature of literacy.

The third factor that prompts the deictic nature of literacy is the use of increasingly efficient technologies of communication that rapidly distribute new literacies. The Internet and other ICTs not only change themselves, but they also provide the central vehicle for exchanging new technologies for information and communication. Increasingly, for example, we simply download new technologies from the Internet when these appear rather than receive a CD or other storage medium through the traditional mail system. Because we can now immediately download a new technology from the Internet or send it to millions of individuals with just a keystroke, the changes to literacy derived from new technologies now happen at a faster pace than ever before. This increases the already rapid pace of change in the forms and functions of literacy, increasing the complexity of the challenges we face as we consider how best to prepare students for their literacy futures. Thus, the rapid pace of change in the forms and functions of literacy are

exacerbated by the speed with which new technologies and new envisionments are communicated (Leu, 2000a).

In summary, we believe that the deictic nature of literacy will increase in the years ahead, limited only by our own ability to adapt to the new literacies that emerge. People, not technology, will limit the speed with which new literacies appear.

The Relationship Between Technology and Literacy Is Transactional

Technology transforms the forms and functions of literacy (Reinking, 1998), but literacy also transforms the forms and functions of technology. Thus, the relationship between literacy and technology is transactional. We have argued above, and most would agree, that new technologies for information and communication require new literacies to fully exploit their potential. It is important to recognize, however, that when we use technology in new ways, we also transform the technology itself, creating additional new literacies in the process.

The most common mechanism by which users transform a technology through their literate behavior is what we have referred to earlier as an envisionment. When individuals imagine new possibilities for literacy, transform the function or the structure of existing technologies to construct this vision, and then share their work with others, an envisionment has occurred.

In addition, though, technology is transformed through instructional practices in literacy classrooms. This happens every day on the Internet when educators construct new curricular resources with Internet technologies and then share their work with others (Leu et al., 1999). Examples include the following:

- Harriet Tubman & The Underground Railroad (www2.lhric.org/pocantico/tubman/tubman.html), a site developed by Patty Taverna, Terry Hongell, and Patty's second-grade class at Pocantico Hills School in Sleepy Hollow, New York

- Earth Day Groceries Project (www.earthdaybags.org), an environmental project developed by Mark Ahlness, a third-grade teacher in Seattle, Washington

- SCORE Cyberguides (www.sdcoe.k12.ca.us/score/cyberguide.html), a collection of Internet resources for individual works of literature contributed by teachers and coordinated by the San Diego schools

- Book Rap (http://rite.ed.qut.edu.au/old_oz-teachernet/projects/book-rap/), literature discussion groups run over the Internet from Australia

While these new instructional tools, and thousands of others that are appearing, provide important resources for the literacy classroom, each also requires additional new literacies for their effective use.

New Literacies Are Multiple in Nature

A New Literacies Perspective recognizes that a singular label, literacy, fails to capture the complexity of the changes that can only be captured by a plural label. Increasingly, scholars are beginning to recognize that changes taking place result in multiple new literacies required in different social contexts. For example, The New London Group (2000) defines *multiliteracies* as a set of open-ended and flexible multiple literacies required to function in diverse contexts and communities. We believe the same multiplicity of literacy is emerging because of multiple technological contexts. We believe that the Internet and other ICTs require that we develop a systematic understanding of the multiple literacies that exist within these many different contexts. This multiplicity of new literacies is apparent on at least three different levels.

The first level of multiplicity that characterizes the new literacies of Internet technologies is that

meaning is typically represented with multiple media forms. Unlike traditional text forms that typically include a combination of two types of media—print and two-dimensional graphics—Internet texts integrate a range of symbols and multiple-media formats including icons, animated symbols, audio, video, interactive tables, virtual reality environments, and many more (Brunner & Tally, 1999; Lemke, 1998). Also, Web designers often use nontraditional combinations of font size and color, with little uniformity in style and design from one website to another (Ciolek, 1996). As a result, we confront new forms and combinations of texts and images that challenge our traditional understandings of how information is represented and shared with others. The multiplicative effects of these unique combinations of multiple-media forms (Lemke, 1998) demand that students "understand how various literacies and various cultural traditions combine these different semiotic modalities to make meanings that are more than the sum of what each could mean separately" (p. 288). For traditional language arts curriculums that tend to focus on the process of making meaning from text as opposed to critically analyzing and interpreting the messages within images, Internet technologies require literacy educators to broaden their definitions of literacy to encompass these new, complex, and multiple forms of Internet literacies.

The second level of multiplicity is that the Internet and other ICTs offer multiple tools for constructing multiple forms of communication. Literate individuals will be those who can effectively assess their individual purposes for using the Internet and then seek out, from the Internet's many offerings, the particular tool and form that best meet their needs. For example, when seeking particular information, readers will need to know procedures for using keywords within the most appropriate type of search engine while those hoping to browse online resources for the sake of open-ended exploration should be familiar with the hierarchical categories of information indexed by many search engines. Similarly, when hoping to communicate asynchronously with others, Internet users should be literate in tools such as e-mail, listservs, and discussion boards. When seeking more real-time interactive forms of information, Internet users need to have an understanding of how to access instant messaging technologies, communicate effectively with video conference technologies, participate in chat rooms, and enter virtual environments. A New Literacies Perspective assumes that proficient users of the Internet also will understand how to construct, design, manipulate, and upload their own information to add to the constantly growing and changing body of knowledge that defines the Internet.

A final level of multiplicity that characterizes the new literacies of Internet technologies consists of the new skills demanded by our students as they more frequently encounter information from individuals in different social contexts. In schools, at home, and in the workplace, the Internet provides opportunities for individuals to meet and exchange ideas, yet it is important to realize that each of these ideas is not an isolated piece of information but, rather, is shaped by the social and cultural contexts in which each of us exists. Typically, students are accustomed to exchanging information with others within their own classroom, school, or neighborhood and usually are not surprised by what they learn through these exchanges. However, the global sharing of information permitted by the Internet introduces new challenges for students now expected to interpret and respond to information from multiple social and cultural contexts that share profoundly different assumptions about our world. These multiple contexts for new literacies have important implications for educators preparing students to critically understand and interpret the meaning of text and images they find on the Internet.

Critical Literacies Are Central to the New Literacies

Another central principle of the new literacies is that they demand new forms of critical literacy and additional dependence on critical thinking and analysis as one encounters information. Open networks such as the Internet permit anyone to publish anything; this is one of the opportunities this technology presents. However, this open access also is one of the Internet's limitations; information is much more widely available from people who have strong political, economic, religious, or ideological stances that profoundly influence the nature of the information they present to others. As a result, we must assist students in becoming more critical consumers of the information they encounter (Alvermann et al., 1999; Muspratt et al., 1998). Although the literacy curriculum (and assessment programs) have always included items such as critical thinking and separating fact from propaganda, richer and more complex analysis skills will need to be included in classrooms where the Internet and other ICTs begin to play a more prominent

role.

As we begin to study the new literacies of the Internet we will depend greatly on work from the communities of critical literacy and media literacy and will be informed by research that targets higher-order thinking about what is being communicated. Multiple, critical literacies populate the new literacies of the Internet, requiring new skills, strategies, and insights to successfully exploit the rapidly changing information and media technologies continuously emerging in our world.

New Forms of Strategic Knowledge Are Central to the New Literacies

Mayer (1997) has reminded us that each technology contains different contexts and resources for constructing meanings and requires somewhat different strategies for doing so. New technologies for networked information and communication are complex and require many new strategies for their effective use. Hypertext technologies, for example, embedded with multiple forms of media and unlimited freedoms of multiple navigational pathways, present opportunities that may seduce some readers away from important content unless they have developed strategies to deal with these seductions (Lawless & Kulikowich, 1996; Lawless, Mills, & Brown, 2002). Other cognitive and aesthetic changes to text on the Internet present new challenges to comprehension (Coiro, 2003; Spires & Estes, 2002), inquiry (Eagleton, 2001), and information seeking (Sutherland-Smith, 2002) as well. Moreover, as we have argued, the technologies of the Internet will continue to change regularly and rapidly, presenting us with even newer technologies of literacy that demand more (and more sophisticated) strategies to effectively exploit them. Thus, the new literacies will be largely defined around the strategic knowledge central to the effective use of information within rich and complexly networked environments.

There will be many types of strategic knowledge important to the new literacies. We can be certain, though, that they will include the new forms of strategic knowledge necessary to locate, evaluate, and effectively use the extensive resources available within the Internet. The extent and complexity of this information is staggering. Moreover, these already extensive resources increase each day as new computers are connected to networks and as people create new information and publish it for others to use. They require new forms of strategic knowledge in order to exploit them effectively. How do we best search for information in these complex worlds? How do we design a webpage to be useful to people who are likely to visit? How do we communicate effectively with videoconference technologies? How do we function in the virtual worlds that are being developed as social learning environments? What are the rules for participating on listservs, chatrooms, bulletin boards, and other electronic communication environments? These questions highlight the central role that strategic knowledge will play for people who communicate using the new literacies of the Internet and other ICTs.

Speed Counts in Important Ways Within the New Literacies

In a world of vast information resources, the new literacies of the Internet will be defined in important ways around the rate at which one can read, write, and communicate. Within competitive information economies where problem identification and solution are critical, the rate at which one can acquire, evaluate, and use information to solve important problems becomes central to success. The speed it takes to acquire information will become an important measure of success within various technologies. Quickly finding, evaluating, using, and communicating information will become central instructional issues.

As speed becomes essential for the effective use of the new literacies of the Internet and other ICTs, it will be critical to solve the equity issues that result from children who process and communicate information at different rates. Slow readers and writers are challenged within traditional literacies; within the new literacies of the Internet these individuals will be left far behind. The gap between highly literate and literacy challenged individuals will be exacerbated by the new literacies of the Internet. Highly literate individuals will skim webpages, link to other webpages, and generally sift through large amounts of information in a short time. Individuals who read slowly and haltingly will still be evaluating the first screen of information by the time a more rapid reader has already completed the informational task. If we truly seek to enable every student to succeed in a society defined by information and the speed with which it may be

accessed, we will need to devote substantial resources to discover solutions to this important issue.

Learning Often Is Socially Constructed Within New Literacies

We expect that social learning strategies will be central to literacy instruction in the future, and here we highlight two dimensions that are important to recognize within our current framework of a New Literacies Perspective.

First, social learning plays an important role in the exchange of new skills and strategies needed to interact within increasingly complex and continually changing technologies for information and communication. Models of literacy instruction often have focused on an adult whose role is to teach the skills he or she possesses to a group of students who do not know those skills. This is no longer possible, or even appropriate, within a world of multiple new literacies framed by the Internet and other ICTs. In fact, today, many young students possess higher levels of knowledge about some of these new literacies than most adults. It is simply impossible for one person to know all the new literacies and teach these directly to others. Each of us, however, will know something unique and useful to others.

Consequently, effective learning experiences will be increasingly dependent on social learning strategies and the ability of a teacher to orchestrate literacy learning opportunities between and among students who know different new literacies. This will distribute knowledge about literacy throughout the classroom, especially as students move above the stages of foundational literacy. One student, for example, may know how to edit digital video scenes in the hope of including these within a webpage, but another may know how best to compress the video so that it can function optimally in a Web-based environment. In a student-centered, social learning environment, this knowledge can be exchanged, ironically, in a classroom where the teacher may not know either of these skills as well as the students. By orchestrating opportunities for the exchange of new literacies, both teachers and students may enhance their literacy skills and their potential for effective communication and information use. This social learning ability may not come naturally to all students, however, and many will need to be supported in learning how to learn about literacy from one another (Labbo, 1996; Labbo & Kuhn, 1998).

If, as we believe, literacy learning becomes increasingly dependent on social learning strategies, socially skilled learners will be advantaged while "monastic learners," children who rely solely on independent learning strategies, may be disadvantaged. This will be an important change in many classrooms because individual learning often has been the norm, privileging children who learn well independently. In classrooms where the acquisition of new literacies is important, children who are better at independent learning experiences will be disadvantaged. Increasingly, we must support children who are unfamiliar or ineffective with social learning strategies.

On a second dimension, social learning is not only important for how information is learned, but it also plays a vital role in how information is constructed within the technologies themselves. Much of the Internet is built on the social knowledge constructions of others (e.g., telecollaborative learning projects, threaded discussions, interactive chats, and collaborative databases). Every day, many new websites are developed and serve to expand the global knowledge base shared through Internet technologies. In both the workplace and at home, the new technologies of literacy allow us to take advantage of the intellectual capital that resides in others, enabling us to collaboratively construct solutions to important problems by drawing from the expertise that lies outside ourselves.

Thus, the construction of knowledge will increasingly be a collaborative venture within the learning spaces defined by the Internet and other ICTs. These new technologies will introduce important new instructional challenges for educators, especially with content area contexts. As the Internet and other ICTs bring us closer together, students will need to be prepared for the important, collaborative co-construction of new information and the learning that results (Jonassen, in press; Jonassen, Howland, Moore, & Marra, 2003).

Teachers Become More Important, Though Their Role Changes, Within New Literacy

Classrooms

The appearance of the Internet and other ICTs in school classrooms will increase, not decrease, the central role that teachers play in orchestrating learning experiences for students. Teachers will be challenged to thoughtfully guide students' learning within information environments that are richer and more complex than traditional print media, presenting richer and more complex learning opportunities for both themselves and their students. Moreover, in a world of literacy as deixis, new literacies will continuously emerge from even newer technologies, requiring teachers to be (a) aware of emerging technologies for information and communication, (b) capable of identifying the most important new literacies that each requires, and (c) proficient in knowing how to support their development in the classroom.

The teacher's central role will change in a fundamental way, however. Teachers will increasingly need to orchestrate complex contexts for literacy and learning rather than simply dispense literacy skills, since they will no longer always be the most literate person in the classroom. Increasingly, students are coming to school more literate in the new literacies of ICTs than their teachers (Chandler-Olcott & Mahar, 2003). This is a historic change. As a result, roles between student and teacher will sometimes be reversed. Skilled teachers will take advantage of this by constructing contexts for learning in which students who possess new literacies are valued and are supported in sharing their expertise with others. Instead of being the single source for all literacy knowledge, teachers will become orchestrators of literacy learning environments, where members of a classroom community exchange new literacies that each has discovered.

Students with teachers who make thoughtful decisions about what needs to be learned and how it should be learned in new literacies will be privileged; those with teachers who have not yet figured these things out will be disadvantaged, perhaps even more so than with foundational literacies. Because teachers become even more important to the development of literacy in a world of new literacies, greater attention will need to be placed on teacher education and professional development.

A New Literacies Perspective: Implications for Research and Practice

A New Literacies Perspective tells us that the Internet and other continuously emerging ICTs will be central to literacy in both our personal and professional lives and that these technologies require new literacies in order to effectively exploit their potential (IRA, 2002; Kinzer & Leander, 2003; Leu, 2002). It also tells us that it is essential to begin to integrate these new literacies into classrooms if we hope to prepare all students for the literacy futures they deserve (Leu & Kinzer, 2000). In addition, this theoretical perspective suggests that complexity and change define the new literacies of the Internet and other ICTs (Cammack, 2003; Coiro, 2003). Most important, it suggests that the literacy curriculum and assessment practices have not begun to recognize the important new literacies these technologies require (Leu, 2000a; Leu & Ataya, 2002). What is clear from a New Literacies Perspective is that there are important aspects to the literacy curriculum that require our immediate attention for both research and practice.

As we begin to consider the implications of a New Literacies Perspective, we want to make three important points. First, it is important to understand that simply using technology in the classroom does not assure that students are acquiring the new literacies they require. Using technologies such as Accelerated Reader (Topping & Paul, 1999) or other software packages designed to support the acquisition of foundational literacies will not prepare students for the new literacies of the Internet and other ICTs. Using these instructional technologies does nothing to develop the essential skills, strategies, and dispositions that define the new literacies. This type of thinking has been one reason why the field has not moved faster at integrating new literacies into classroom instruction; using software programs to teach foundational literacies is the only vision many have for integrating literacy and technology in classrooms.

Second, a central challenge for both research and practice emerges from the inherently deictic nature of any new literacy. Because new literacies continuously change as even newer technologies require even newer literacies, we require new epistemologies and new instructional

practices that keep up with the rapid changes we anticipate. How, for example, can we keep up with new ideas about what to teach within research and dissemination paradigms that require four years or more between the conception of a research problem and the wide dissemination of results through research journals that rely on printed volumes? How can we keep up with new ideas about how to teach with these technologies when the technologies themselves regularly change? How can we assess students on their ability to use the Internet and other ICTs when the very skills we assess will change as soon as new technologies appear? While a New Literacies Perspective does not provide complete answers to these questions, it does suggest that these are critical questions for both research and practice.

Third, and most important, we believe that implementing a New Literacies Perspective in classrooms is essential if we hope to avoid societies in which economic advantage is sustained by the wealthy and denied to the poor. Because of the compounding effect of differences in reading achievement and access to Internet resources by advantaged members of society, we are in danger of developing two classes of citizens: one that is largely poor, minority, and challenged by the new literacies required for reading and learning on the Internet and another that is largely advantaged, white, and excels with the new literacies required for reading and learning on the Internet. Such a development presents fundamental challenges to any society that professes egalitarian ideals and equal opportunities for all its citizens.

According to data from the National Assessment of Educational Progress (NAEP), reading comprehension in the United States has been generally resistant to efforts at improvement (NCES, 2003b). Of particular concern, white fourth-grade students scored at or above the "basic" level of reading at nearly twice the rate as many minority groups (NCES). Just as troubling, economically advantaged students at the fourth-grade level scored at or above the "basic" level of reading at nearly twice the rate compared to disadvantaged students (NCES, 2003b). Most troublesome of all, the achievement gap is increasing between high- and low-performing students. Since 1992, NAEP average reading scores for high-performing students have increased, while those for low-performing students have dropped (NCES, 2003b). Given the powerful connection between reading comprehension ability and learning (Alexander & Jetton, 2000; Bransford, Brown, & Cocking, 2000), it is clear that the United States is developing two classes of learners.

As challenging a picture as the NAEP data present, they do not yet reflect students' ability to read and comprehend within the complex, networked, informational spaces of the Internet. The Internet requires new literacies to achieve high levels of reading comprehension in this context, but we know very little about what these literacies are or how best to teach them. The report of the RAND Reading Study Group (2002), *Reading for Understanding: Toward an R&D Program in Reading Comprehension,* captures the essence of the problem: "Accessing the Internet makes large demands on individuals' literacy skills; in some cases, this new technology requires readers to have novel literacy skills, and little is known about how to analyze or teach those skills" (p. 4).

The Internet is also a reading context where digital divide issues abound (Solomon, 2002). It is clear that advantaged and white students have far greater Internet access at home than disadvantaged and minority students (Lebo, 2003). Because the skills necessary to achieve high levels of reading comprehension on the Internet are seldom taught in schools (Padron & Waxman, 1996; Warschauer, 2003; Wenglinski, 1998), the skills are more often acquired at home by those economically advantaged members of society who have the greatest access to the Internet and more extensive learning opportunities (Warschauer, 2003).

Before we can expect all students to be prepared to read and comprehend at high levels on the Internet, we must provide scientific data to demonstrate what these skills are, how to assess them, and how best to teach them (Coiro, 2003; RAND Reading Study Group, 2002). Despite the perceived importance of the Internet as a context for teaching and learning (Web-Based Education Commission, 2000); U.S. Department of Education, 1999), relatively little research exists on the new literacies the Internet requires for achieving high levels of reading comprehension (National Institute of Child Health and Human Development, 2000). This situation must change.

Issues of What Should Be Taught and Learned Within a Context of Continuous Change

A New Literacies Perspective suggests that an aggressive agenda of research must be launched immediately in order to better understand the new skills, strategies, and dispositions required to effectively use the Internet and other ICTs. Little work, especially by the literacy research community, has been conducted in this area. And, it is the literacy research community that needs to bring powerful insights about literacy, instruction, and learning to these issues. The task is so large, involves literacy in such profound ways, and must be accomplished so quickly that it is not possible to vest the responsibility for this work solely in the hands of those who have traditionally explored issues of technology or even literacy and technology. Each of us must bring our special area of expertise to the study of literacy within the new worlds of the Internet and other ICTs.

Scholars who study reading comprehension, for example, need to examine the various components of meaning construction to help us understand the extent to which comprehension processes are similar or different within the multimedia, hyperlinked contexts of the Internet and other ICTs (Coiro, 2003). Reading comprehension is likely to be a major area of investigation because the Internet and other ICTs focus so much on information and learning from text. However, given recent models (RAND Reading Study Group, 2002) that define reading comprehension in terms of reader, text, and task, the parameters of reading comprehension on the Internet are likely to expand to include problem identification, search strategies, analysis, synthesis, and the meaning construction required in e-mail messages and other communication technologies. Many questions await investigation: What new aspects of comprehension are required when reading information on the Internet? Are inferential processes and strategies similar or different on the Internet? How do other aspects of the comprehension process change? Reading comprehension strategies within this context are likely to be especially important, and we need to know what these are.

Scholars doing work in early literacy must bring their special insights to help us understand when and in what ways young children should begin to read, write, and communicate with ICTs. We have always viewed the early years as critical to literacy development. These scholars must now turn their attention to the new literacies emerging from new technologies, helping us to understand how best to teach these new literacies in ways that answer the call for technology use that is developmentally appropriate, equitable, and integrated into the regular literacy learning environment of young children (National Association for the Education of Young Children, 1996).

Media literacy scholars, too, need to bring their understanding of critical literacies to the study of what students need to learn within the new literacies of the Internet and other ICTs. Earlier we argued that critical literacies are essential to reading on the Internet because issues of stance, information shaping, and information validity become so important within an information space where anyone may publish anything. Consequently, there is new sense of urgency in ensuring that students develop an awareness of the diverse perspectives around any question they investigate. Literacy educators will need to incorporate more strategies like those suggested by Brunner and Tally (1999) to foster deeper student insight into the various ways of looking at the same event, for example, viewing a historical event from the perspective of the different people involved (e.g., viewing a Civil War video series while "looking for evidence of the way average soldiers, in contrast to generals, or men in contrast to women, or white in contrast to blacks, experienced the war" [p. 46]).

Scholars in the areas of composition and communication also have much to contribute to this work. They must bring their powerful lenses to bear on issues of e-mail communication, webpage and multimedia composition, and the many other important issues we need to understand in these areas. Clear, rapid, and effective communication that takes advantage of the networked information contexts of ICTs will be central to our students' success. We need to know how to support students in achieving these abilities.

Although many of us have not yet recognized it, insights from multicultural and cross-cultural education also are going to be especially critical to our effective use of ICTs (Leu, 1997b). We

need the finest minds in this area to help us understand the important experiences taking place as classrooms link to other classrooms from different cultural contexts, engaging in cooperative projects and seeking to understand one another's cultural context. As we engage in this important work, enormous potential exists to understand the advantages that diversity bestows by bringing multiple perspectives to bear on important problems that face us all. The Internet permits us to construct new definitions of multicultural education and broadens the definition of diversity in the classroom to global dimensions. If we take full advantage of these new opportunities the Internet will allow us to construct a truly global village among classrooms that shows students how to take full advantage of the many benefits that diversity bestows.

A central challenge for each of us is how to use these new technologies to support students with special needs. It is quite possible that the gap between proficient readers and less-proficient readers will increase within the world of rich, complexly structured information networks as the effects of differences in reading rate and accuracy become magnified. If we do not wish to leave a single child behind, we must focus on the issue of how best to support students with special needs with the powerful new technologies that are available to us.

Our colleagues who conduct research on teacher education also have an enormous agenda ahead. They need to apply their finest heuristics, helping us to better understand how to prepare new and experienced teachers to support children in the new literacies of ICTs in the classroom. Increasingly the challenge for classrooms is one that is changing from access to the thoughtful use of powerful new technologies for literacy. We need important new models and clear data to direct us in this area.

Scholars exploring important agendas in adolescent literacy and content area literacy may have the most to contribute. Research in these areas can help us to better understand ways to support information acquisition, develop the critical evaluation skills essential to effective use of Internet resources, and develop strategies for the effective use of information to solve important problems.

Scholars in the area of teacher research also have important work ahead of them. We know that some exceptional teachers are developing new insights and new models of instruction on the Internet (Karchmer, 2001). We need to know how to take advantage of these learning experiences and use the insights developed by these exceptional teachers to support our work in teacher education and staff development.

We also need to invite scholars in the areas of adult literacy to the research table. We cannot afford to abandon adults who have not had the advantage of being prepared for the new literacies required of an information economy. It may be a special challenge to broaden the literacy skills of this population because they do not have the advantage of growing up in a rich multimedia and technology world the way many children have. But, if we succeed in involving adults, it will provide us with special opportunities to take advantage of their many years of experience. Intellectual capital is important to all of us in a networked information context. We cannot afford to lose any of it.

Family literacy scholars are essential, as well, to the research that must be done. Networked information resources provide special opportunities to connect schools with families. How can we best take advantage of information networks to support a collaborative effort in students' education? How can we ensure access to ICTs in the home? We need answers to these questions if we seek to provide the best learning environment possible for every child.

Additionally, scholars in the areas of children's and adolescent literature have much to contribute. New forms of literature, written by students themselves, are beginning to emerge as the Internet makes possible new publishing opportunities. We need to know how best to support the integration of these new opportunities for literacy and learning into school classrooms.

Finally, while considering the contributions we require in all these areas, we also may wish to consider the important consequences resulting from a deictic vision of new literacies for what students need to learn. The continuously changing technologies of literacy mean that we must

help children "learn how to learn" new technologies of literacy. In fact, the ability to learn continuously changing technologies for literacy may be a more critical target than learning any particular technology of literacy itself.

In this section, we have presented just some of the areas that require the attention of our brightest minds, our most talented scholars, and all our teachers. The work ahead is immense and requires us to pool all our talents if we are to understand the new skills, strategies, and dispositions that students must acquire in the new literacies of the Internet and other ICTs.

Issues of How to Teach Within a Context of Continuous Change

As we consider issues related to how to teach and learn the new literacies of the Internet and other ICTs, it is likely that our focus will turn to understanding the social and constructivist nature of learning strategies that new literacies demand. We indicated earlier that social and constructive perspectives would be important to the construction of new information within the technologies themselves. Both of these areas are important to research and practice within a New Literacies Perspective. We need to study how best to support the development of new literacies within classrooms where students will know more than teachers about some new literacies and seek new ways in which to organize and orchestrate classroom learning to take advantage of the new literacy knowledge others are acquiring. In short, we need to determine the most effective ways to manage learning experiences in the new literacies when these literacies are distributed throughout a classroom. As we do this, we also need to understand how best to collaboratively construct new information with the Internet and other ICTs, a potential that is at the very heart of most new literacies.

The lessons that classroom teachers are acquiring about both of these issues are important to understand. In fact, we believe that teachers who integrate the Internet and other ICTs into their classrooms will contribute as much—and perhaps more—than traditional researchers to understanding the most effective instructional practices for supporting the development of new literacies. The Internet and other ICTs permit teachers to rapidly connect with other teachers to share successes and exchange insights about how best to teach the new literacies (Karchmer, 2001) and it will be important to study how classroom teachers connect with others, exchange information, and construct new visions of best practices. Resources such as RTEACHER (see www.reading.org), a listserv sponsored by the International Reading Association, where teachers and others can exchange ideas about successful practices, are just the beginning of new epistemologies that will be required to keep up with the rapidly changing nature of information about instructional practice that is a part of the changing nature of the new literacies.

What seems certain is that Internet resources will increase the central role that teachers play in orchestrating learning experiences for students as literacy instruction converges with Internet technologies. Teachers will be challenged to thoughtfully guide students' learning within information environments that are richer and more complex than traditional print media, presenting richer and more complex learning opportunities for both themselves and their students. This alone should make teacher education and professional development issues important priorities. In addition, however, we must recognize that as the new literacies continually change, new professional development and teacher education needs will emerge. It is safe to say that our educational systems have never before faced the professional development needs that will occur in our future. The Internet, however, provides us with new opportunities to rapidly disseminate new models of effective instruction. Models of dissemination that take advantage of the communication potential in these new technologies, such as those developed by the Case Technologies to Enhance Literacy Learning (CTELL) group (Teale, Leu, Labbo, & Kinzer, 2002), may become increasingly important.

Issues of Assessment Within a Context of Continuous Change

A fundamental challenge to the integration of new literacies into the curriculum, at least in the United States, is that we currently do not include these important literacy skills on national and state assessments. Given the evidence that teachers emphasize literacy skills appearing on important assessments (Linn, Graue, & Sanders, 1990), there is little incentive for teachers to

make new literacies a central part of the curriculum until these are included in state and national standards and on literacy assessments.

The best evidence that educational systems ignore the new literacies of Internet technologies, at least in the United States, can be seen in the state assessment programs that evaluate children's performance in reading and writing. New literacies, such as reading on the Internet or within other ICTs, are not included on any state assessments, and most states have no immediate plans to include these within literacy assessments (Leu & Ataya, 2002). Moreover, most states have seen the assessment of new literacies, such as comprehending text on the Internet, composing e-mail messages, or writing with a word processor, as a technology assessment issue, not a reading or writing assessment issue. This continues to occur even though the ability to locate, read, and evaluate information on the Internet is increasingly a part of our daily lives (Lebo, 2003). In addition, not a single state permits any student who prefers to use a word processor to do so during state writing assessments, unless this is formally specified in a special education student's Individualized Educational Plan. This continues to occur despite evidence that nearly 20% more students are able to pass the Massachusetts state writing assessment when permitted to use word processors (Russell & Plati, 2000).

There are other challenges we face in the assessment of new literacies. The most prominent one, perhaps, is that literacy assessments, to date, are always assessments of an individual working alone. Given the importance of social learning and collaborative meaning construction on the Internet and other ICTs, we will need to begin to assess how well students can learn new literacies from others and how well they can co-construct meaning and collaborate in constructing written information with others. As we have pointed out, learning how to learn from others and learning how to collaboratively construct meaning will be increasingly important. It seems clear that new technologies will require new approaches to both what is assessed and how we go about the assessment (Pellegrino, Chudowsky, & Glaser, 2001).

Concluding Thoughts About a New Literacies Perspective

Change increasingly defines the nature of literacy and the nature of literacy learning. New technologies generate new literacies that become important to our lives in a global information age. We believe that we are on the cusp of a new era in literacy research, one in which the nature of reading, writing, and communication is being fundamentally transformed. To inform this journey, we have defined a New Literacies Perspective, which provides a useful starting point to inquiry in this area. We have explained how literacy has changed regularly throughout time, influenced by important social forces and technologies. We explored the social context of the current period including global economic competition, the rise of the Internet and other ICTs, and educational policies from nations around the world that emphasize higher achievement in literacy and the effective use of information technologies. Then, we reviewed emerging theoretical perspectives in this area and explained why we believe a New Literacies Perspective is especially useful to understand the changes that are taking place. Finally, we presented a set of principles that inform our research in this area and discussed some of their more challenging implications to both research and practice.

It will be up to each of us to recognize the continually changing nature of literacy and to develop a rich understanding of these changes. We hope that you will bring your own expertise to the important work that lies ahead as we all seek to prepare students for the new literacies of the Internet and other ICTs that define their future. They deserve nothing less.

Note

[1] Portions of this section are an expansion of work that appeared originally in Kinzer and Leander (2003), and quotations from this section should reference that work.

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* indicates that article is included on TMPR5 supplementary CD

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