CHAPTER 11

Digital Literacies in the Classroom

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The 21st century is a period of dramatic change in defining literacy. Contemporary students use both traditional text and digital media to communicate and locate information for both in- and out-of-school purposes. This period of change has required researchers, educators, and students themselves to redefine and expand their concept of literacy. This chapter briefly addresses the changing definition of literacy, including a description of digital literacy as it relates to classroom contexts. Multiple perspectives on the emerging definition of digital literacy are presented to encourage further refinement of the construct. In addition, current classroom applications of digital technologies in the areas of oral and written language and two major components of reading, vocabulary development and comprehension are outlined. Extant research related to the use of digital literacy and the study skills adolescents require to become literate in an electronic environment are described. The developing uses of social networking and gaming as a support to classroom instruction are also introduced. The study of the field faces particular challenges: Researchers experience unique problems as they study technology applications that become obsolete before the research results are even published; educators encounter students with a variety of levels of technology skill and reading ability, who are asked to navigate in hypertextual environments using comprehension techniques that differ from those used in linear reading environments; teachers feel a pressing need to increase their own technology skill levels while providing instruction for adolescents who are technologically savvy. This chapter provides instructional approaches and research that address the increasing need for students to read critically, access information efficiently, and overcome the negative impact of the digital divide.

The 21st century has seen profound change in the definition of what it means to be a literate member of society (New Media Consortium, 2005). Today's students are in the midst of a dramatic paradigm shift, similar to the changes experienced during the revolution created by the advent of the printing press (Harnad, 1991; McLuhan, 1962). Contemporary students use both traditional text and digital media to communicate, purchase goods and services, and locate information needed for both in- and out-of-school activities. Web 2.0, a second generation of computer applications that goes "beyond the page metaphor of Web 1.0 to deliver rich user experiences" in online environments, is commonly used and modified by today's students (O'Reilly, 2005). Online applications,

like wikis, allow for the remixing of information and individual contributions to collective written work (e.g., Wikipedia). *Time* magazine recognized the profound impact of Web 2.0 on society, including our youth, when it named "You," the public, as *Time*'s 2006 Person of the Year, honoring citizens for "seizing the reins of the global media, for founding and framing the new digital democracy, for working for nothing and beating the pros at their own game" (Grossman, 2006/2007, p. 14).

As recently as 1992, Landow suggested that the shift from paper-based to digital text paralleled the Gutenberg revolution and, like the move to easily accessible printed text, use of digital text forms would take time to become routine. By 2001, findings from the Pew Internet and American Life Project showed that 73% of students ages 12–17 used the Internet regularly (Lenhart, Simon, & Graziano, 2001). This transition was also evident in research on the electronic study skills used by international students, ages 14–25, when 89.9% of participants reported they read from electronic text (Robnolt, Rhodes, & Richardson, 2005). The rate of change to and within digital environments is accelerating at such a rapid pace that print culture cannot keep up with the demands of reporting on digital culture. As Harnad points out:

> Paper has always had one notable drawback. Although it allowed us to encode, preserve and share ideas and findings incomparably more effectively than we could ever have done orally, its tempo was always lamentably slower than the oral interactions to which the speed of thought seems organically adapted. (1992, p. 40)

The use of electronic text eliminates the speed constraint of paper environments and creates the possibility for global, interactive dissemination of information. Therefore, this work, as well as other synoptic views of digital culture, are out of date as soon as they are written.

Although the use of digital text affords many learning opportunities for students, without access to technology, students from economically disadvantaged communities are unable to benefit. Attewell (2001) suggests that there are two digital divides separating the "haves" from the "have nots." Digital equity should be considered, first, in terms of student access to technology and, second, in terms of student use of technology for educational purposes. DeBell and Chapman (2003) noted several inequities in student access to technology in their analysis of data from the *Computer and Internet Use Supplement* to the *2001 Current Population Survey* (CPS) conducted by the U.S. Census Bureau. DeBell and Chapman found that students ages 5–17 without disabilities were more likely to use the Internet and computer than those with disabilities. Students living outside urban areas and those from two-parent families were also more likely to have computer access. In his study of digital equity in 3,479 schools across 40 states, Becker (2006) reported that African American students and those living in rural areas had less access to educational technology. In addition, findings indicated that when students had access to technology, girls and students in a free or reduced-cost lunch program were most likely to use computers.

The role of schools in bridging the gap for students who lack access to technology at home was clearly evident in the CPS data analysis (DeBell & Chapman, 2003). The researchers found that students from families in poverty and those with parents who had not earned a high school credential reported accessing the Internet only at school. Fifty-two percent of young people from families in poverty access the Internet only at school, as compared with 26% of families living above the poverty level. Moreover, 59% of students whose parents lack a high school credential versus 39% of those who have higher education levels use the Internet only at school. This type of comparison illustrates the importance of ensuring that access to computer technology is equitable in public schools in order to reduce the digital divide and allow youngsters to gain experience working in electronic environments that are essential for economic survival in the 21st century (DeBell & Chapman, 2003).

There have been some improvements in students' access to the Internet since the digital divide began to be viewed as a potentially serious social problem. Krueger (2000) reported that in 1984 Black students were 16% less likely than White students to use a computer in school. This gap was reduced in

997 to 6% overall, with a complete disappearance of the gap for high school students in the same year, but students in grades 1–8 still experienced a 10% difference.

Further evidence of improvement in access to computers was reported in 2003, when the National Center for Educational Statistics (NCES) noted that public schools in the United States increased access to the Internet from 35% of schools in 1994 to nearly 100% in 2003. Public schools also made progress in providing Internet-accessible computers to 93% of the instructional rooms in 2003, as compared with only 3% of instructional rooms in 1994 (National Center for Educational Statistics, 2005).

THE CHANGING DEFINITION OF LITERACY

Learning in today's literacy environment requires students to have functional skill and knowledge for working in both traditional (i.e., paper-based) and electronic text environments. This continuing transition from a reliance on paper-based material to reading in multimedia, hypertextual environments necessitates the redefinition and expansion of the concept of literacy for both students and educators. Many definitions of literacy have focused on individual competence. For instance, literacy can be defined as a "minimal ability to read and write in a designated language, as well as a mindset or way of thinking about the use of reading and writing in everyday life" (Venezky, 1995, p. 142). Literacy is more than simply reading or writing because it "requires active, autonomous engagement with print and stresses the role of the individual in generating as well as receiving and assigning independent interpretations to messages" (Venezky, 1995, p. 142). Furthermore, this understanding of literacy has evolved into other areas of knowledge (e.g., economic literacy, cultural literacy, and computer literacy) to designate minimal competence required in each field.

Currently, the term *literacy* implies that individual competence interacts with the social demands of the culture. Literacy levels vary across time and cultures on a continuum ranging from illiteracy to high-functioning literacy. For instance, what was considered a more than adequate level of literacy during the industrial revolution would not be considered sufficient for the literacy demands in current society (Venezky, 1995).

A challenge for those interested in the literacy required for reading in electronic environments is the creation of a label, nomenclature, and definition of each of the literacies involved. Soares (1992, as cited in Harris & Hodges, 1995) indicated that "consensual agreement on a single definition [of literacy] is quite implausible" even for the general term itself (p.140). However, for meaningful discussion of the topic, the field must work toward finding a common understanding of multiple digital literacies.

The challenge of defining literacy in the 21st century is obvious. Researchers, technology gurus, educators, and the public all search for a valid definition of the literacy required for success in new digital environments. In the past, the idea of computer literacy implied acquisition of a skill set needed to function in a computer environment. Students were expected to demonstrate an understanding of the value of computers, knowledge of computer terminology and a computer language, and the ability to use computers to solve problems (Troutner, 1985). Across time technological advances have placed new and varied literacy demands on students. Today students must navigate through hypertext environments where linear movement through text is interrupted with opportunities for linking to other related items with the click of a button. Further, the very relationship of author and reader has become muddied as readers create written work for mass consumption and contribute to the revision of online text. Various researchers have approached defining computer literacy in the midst of this period of extraordinary change.

DEFINITIONS OF LITERACY IN THE NEW MILLENNIUM

Defining literacy in the new millennium is a highly complex task. This section provides a brief overview of several definitions of literacy proposed by contemporary researchers studying the demands of digital environments. Each definition broadens the understanding of literacy, but none appears to

have been able to assist in arriving at a fully acceptable construct for future use.

Multiliteracies

In 1994, ten educators met in New London, New Hampshire, to discuss literacy pedagogy (Cope & Kalantzis, 2000). The discussion and resulting article from the New London Group helped broaden the understanding of literacy and literacy teaching to account for the use of multimedia technologies and the multiplicity of available text forms. Focusing on the idea of a multiliteracies approach to pedagogy allowed the New London Group to consider the various ways information is communicated and the expanding relationships between text and other representational forms. *Multiliteracy* implies that meaning making occurs in multimodal settings where written information is part of spatial, audio, and visual patterns of meaning. These individual modes are in dynamic interaction with one another during literacy activities (Cope & Kalantzis, 2000).

To be successful, students are expected to comprehend multimodal materials and deal not only with changes in mass media and technology, but also with cultural and linguistic diversity, multiple languages, and cross-cultural communications that go beyond national boundaries. The New London Group (1996) asserted that multiliteracies approaches would ensure that students were able to deal with modern literacy demands and achieve two literacy learning goals: "creating access to the evolving language of work, power, and community, and fostering the critical engagement necessary for them to design their social futures and achieve success through fulfilling employment" (p. 1).

New Literacies

Leu (2002) has also attempted to define literacy needed by today's students in light of changing technologies. Leu proposes, "The new literacies include the skills, strategies, and insights necessary to successfully exploit the rapidly changing information and communication technologies that continuously emerge in our world" (Leu, 2002, p. 313). Knobel and Lankshear (2006) assert that new literacies are characterized by two changes: first, the incorporation of ne "technical stuff" (i.e., digitality) and, se ond, new "ethos stuff" (i.e., mindset infor ing literacy practice) (p. 80). The researche suggest that a new literacy may not have involve the use of digitality, but it must co from a mindset that espouses a belief th the world is a different place because of t emergence of digital interworked technol gies. These definitions of new literacies ma be problematic inasmuch as Leu (200 2006) suggests that a *specific* definition fo new literacies may not be possible becau of the deictic, regularly changing nature emerging technologies. For more on ne literacies, see Black and Steinkeuhler (Chap ter 18) and Lewis and del Valle (Chapte 20), this volume.

Information Literacy

Information literacy, also deemed necessar by contemporary scholars, requires student to locate and evaluate information for use a the time it is needed. Information literacy crosses disciplinary boundaries and allow students to have greater control over thei own learning by enabling them to acces needed information, expand investigations, and use information to accomplish specific goals. Information literacy requires individuals to understand the social and ethical issues that surround the use of information (Association of College and Research Libraries, 2000). This definition does not fully capture the variety of ways students use digital environments for self-expression and recreation.

Media Literacy

The National Leadership Conference on Media Literacy, a group of 25 representative leaders of the media literacy movement, met in December 1992 to provide a common vision and objectives for their respective groups. As part of the dialogue, the members settled on a basic definition of media literacy as "the ability of a citizen to access, analyze and produce information for specific outcomes" (Aufderheide, 1993, p. 6). A media-literate person, according to this definition, is able to produce print and electronic media and negotiate meaning in images, words, and sounds. Media literacy also

ffers from a multiplicity of definitions sed on personal perspective or theoretical amework. Media literacy aims to help stu- nts become critical consumers of popular lture and critically reflective about media essages (ReadWriteThink, n.d.). Alvermann d Hagood (2000) indicate that additional rspectives on critical media literacy em- hasize the structure of society and politics, ow gender and power produce cultural ar- ifacts, and how individuals relate to cul- ural texts, depending on their interests and positions. For a further discussion of media literacy, see Bruce (Chapter 19), this volume.

Visual Literacy

Students who are visually literate are able to understand information from pictorial or graphic images (Wileman, 1993). In addition, visual literacy requires students to use and create images using conventional and modern media to communicate, make decisions, and learn (North Central Regional Education Laboratory, n.d.). Although there are some universal visual images, visual literacy is culturally specific. Students develop their visual literacy skills by using them as they create visual messages and by learning visual analysis techniques (Stokes, 2001). Visual literacy is important for students when reading in multimedia environments. A further discussion of visual literacy is included in Zoss (Chapter 13), this volume.

Although a clear nomenclature for the changing literacies has not emerged, the possibility of cohesion of thought among visual literacy, media literacy, and information literacy has been suggested. Tyner (1998) indicates that a synthesis where the three fields link their research might result in a unique name for the concept. Although almost a decade has passed since this suggestion, the fields have not arrived at a singular title for the literacy needed in the post-typographic world.

The challenges of multiple definitions of literacy are evident. Meyer and Rose (1999) suggest that the old definitions of literacy are based on an assumption that "print is the primary carrier of information in our culture" (p. 13). However, each new definition of literacy recognizes that electronic formats are increasingly relied upon to carry information and do so using multiple media for expressing ideas. Owing in part to the challenges of arriving at a clear definition, researchers have shifted focus to the emerging characteristics or skills students will need to be successful in new electronic-based learning environments. Members of the 21st Century Literacy Summit (New Media Consortium, 2005), including representatives from the Massachusetts Institute of Technology (MIT), International Society for Technology in Education (ISTE), and Stanford University, arrived at the following definition of literacy for the new millennium, which demonstrates this focus as they outlined priorities to serve as a literacy road map for the future:

> 21st century literacy is the set of abilities and skills where aural, visual and digital literacy overlap. These include the ability to understand the power of images and sounds, to recognize and use that power, to manipulate and transform digital media, to distribute them pervasively, and to easily adapt them to new forms. (p. 2)

This definition of 21st-century literacy is used synonymously with the term *digital literacy* for the remainder of the chapter. However, the reader should note that in the reporting of research, the nomenclature used by the original author of each work is used.

CHARACTERISTICS OF 21ST-CENTURY LITERACY

Twenty-first century literacy is multimodal, utilizing a variety of levels of meaning, which include the use of sound, visual images including video, and text for communicating (Kress, 2004; New Media Consortium, 2005). Youth must adapt to working in these multilayered environments where messages are received simultaneously in many forms. Literacy for this century implies that students are able to create and interpret meaning within multimodal, digital environments. In addition, students must be able to negotiate hypertext environments that require readers to "transcend the linear, bounded and fixed qualities of written text" (Landow & Delaney, 1991, p. 3). Hypertext allows readers to move through a text nonsequentially, moving from one node to

another as interest or need determines. Although hypertext can be described as the computer-based alternative to paper-based texts (Lawless, Brown, Mills, & Mayall, 2003), its unique multilinear characteristics place new demands on readers and authors alike. Many hypertexts are also multimodal and include hypermedia, defined by Jonassen (2006) as "hypertext with multiple representation forms (text, graphics, sounds, videos, etc.)" (p. 185). Multimedia authoring allows students to develop complex representations while working with audio, visual, and text-based material in constructivist learning processes (Liu & Hsiao, 2002).

Twenty-first century literacy is also characterized by the use of interactive, real-time, synchronous communication, which allows students to communicate using text with an immediacy that was not available in traditional print environments. Members of the 21st-Century Literacy Summit highlighted the potential that new forms of language offer for transforming the way students learn by engaging the brain in new ways, communicating more rapidly, and capitalizing on the natural motivation of students for new literacy activities (Liu & Hsiao, 2002; New Media Consortium, 2005).

The quickly and repeatedly changing reading, writing, and communication activities available in modern society require students to critically evaluate information in increasingly social contexts. In addition, the new literacies include strategic knowledge for locating and evaluating extensive resources in networked environments for use in and outside the classroom. The new literacies are especially evident when students work with content information on the Internet. New literacies also provide opportunities for students to explore their own cultural traditions while communicating in social environments with others across the globe (Leu, 2002).

Digital media provide inclusive environments for communication that support students who have had difficulty in the past working in paper-based text environments. Technology provides access to curriculum and increases personal productivity for disabled students (Jackson, 2004). Twenty-first-century literacy offers additional opportunities for students to express themselves in multiple formats and select from a broader range of tools for specific communicati tasks in both educational and home enviro ments (Meyer & Rose, 1999).

Digital natives (Prensky, 2001), the you who have grown up in a digital era, a learning a new grammar for working wi literacy through their informal computi activities. This knowledge has applicatio in the educational environment as cla rooms begin to keep pace with the litera activities occurring outside the classroom.

STUDENT TECHNOLOGY USE IN THE 21ST CENTURY

When focusing on the needs of both teache and students in the 21st century, one is im mediately confronted by the dramatic differ ences between how adolescents use technol ogy in their home environments and thei uses of computers in school environments. Tyner (1998) indicated that "there has been a growing bifurcation between the literacy practices of compulsory schooling and those that occur outside the school house door" (p. 8). Schooling continues to be based on hierarchical access to paper-based literacy instead of practices that allow students to explore and utilize the multimodal, nonlinear literacies available in digital environments. Digital natives (Prensky, 2001) arriving in today's classrooms are working in an environment that does not match their learning needs and/or the changes in the way their minds process information. Prensky (2001) asserts that the greatest problem facing education is the gap between the knowledge and skills digital natives have developed and the instruction provided by their pre-digital-age instructors. Although 95% of teachers are now comfortable using e-mail, their students have moved on to use more specialized tools (e.g., instant messaging) to meet their communication needs (Project Tomorrow, 2006). Students today are becoming less engaged in old-style instruction that ignores the digital skills they bring to the classroom and enraged with teachers who are not re-creating curricula and instruction to meet their needs (Prensky, 2006). Researchers from the American Institutes for Research found that the use of the Internet by public middle and high school students across the United States occurs pri-

arily outside the school day and with no rection from their teachers (Levin & afeh, 2002).

The need for educational reform contin- s to mount as modern students bring the w literacy skills used in their home envi- nments to the classroom. Students are ending increasing amounts of time on the nternet outside school, participating in a ariety of activities, including social net- orking and online gaming. Project Tomor- ow-NetDay (Project Tomorrow, 2006), a nonprofit organization that focuses on the development of 21st-century science, math, and technology skills, surveyed students in grades K–12 to determine their use of tech- nology for both in-school and out-of-school purposes. Data collected from 185,000 stu- dents from all 50 states, the District of Co- lumbia, Department of Defense schools, Guam, and Puerto Rico show that students are innovative and adopt new technology for personal and educational use. Project To- morrow (2006) reports that students rate lis- tening to music, playing games, and talking to or e-mailing family and friends as the top three ways they spend time at home. Over a third of 12th-grade students use the Internet to keep informed through news websites and are beginning to use podcasts and weblogs as means of sharing and receiving informa- tion (Project Tomorrow, 2006). When they are not in school, much of adolescents' liter- acy happens online through participation in text messaging, chat rooms, e-mail, and blogs (Williams, 2005).

Modern students show their interest in us- ing technology for communication begin- ning in sixth grade, where 50% of students report using e-mail or instant messaging (IM) daily. IM is the preferred method for written communication, according to the 65% of students who use e-mail and IM reg- ularly. E-mail is becoming useful as a repos- itory for needed documents and a means of tracking messages rather than being used for pure communication (Project Tomorrow, 2006; Evans, 2007). A student can hold an e-mail in his or her sent box, which includes Microsoft Word document attachments in- definitely. This allows the student to use the sent box as a holding bin for old documents while saving storage space on a hard drive. Students are also able to keep track of their interactions with peers through reviewing the contents of their e-mail files. Through the use of personal websites and social network- ing sites such as MySpace and Facebook, dig- ital natives share information with friends and connect to others across the globe. These activities provide a broad audience for student sharing of information, writing, and multimedia presentations. Cell phones are becoming the favorite communication tool of youth today and offer increasing potential for educational applications (Project Tomor- row, 2006; Dede, 2007).

Results of the 2006 VNU/Harrison Group Teen Trend survey show that 75% of U.S. teens spend 2–3 hours per day downloading or listening to online music (Olsen, 2006). New computer systems, including the use of MP3 digital audio files, allow students to share music through the Internet with ease (Brown, Sellen, & Geelhoed, 2001). Adoles- cents discover new musical groups through social networking spaces such as MySpace, where listeners post digital music files and add their favorite bands to their "friend space." The accessibility and use of music and other audio recording is enhancing writ- ten text in new multimedia environments. With the recent popularity of Internet sites like YouTube, contemporary students are not only consumers of multimedia, but cre- ators. Students are able to access music and podcasts, create playlists, and record on de- vices such as iPods with great ease of mobil- ity, allowing them to stay connected to con- tent anywhere and any time.

Today's students are also highly involved in playing video games and increasingly use Internet-based large-scale multiple-user games for entertainment. Video games provide stu- dents with an opportunity to apply literacy skills in virtual situations, improve problem solving and strategic thinking, and practice team-building skills. Multiple-user games create environments where students from across the globe engage in online conversa- tions regarding strategy and carry their in- terest in the game culture into reading and writing activities through fanfiction. Through gaming, millennial students are able to test hypotheses in environments where attempt- ing new challenges without fear of failure and developing creative solutions to prob- lems are valued skills (Glazer, 2006). In- creasingly, educators are beginning to see the benefits of multi-use virtual environment

(MUVE) games that simulate real environmental features of geographic areas. Participation in online gaming communities using virtual characters, called avatars, is on the rise, with hundreds of thousands of teens engaging peers in sites such as Second Life (Blaisdell, 2006).

Universities are also beginning to use virtual communication by including Second Life virtual worlds in the academic community (Dede, 2007). Empirical evidence supports adapting the gaming community's use of virtual worlds for educational purposes through programs such as River City, created by a team of researchers from Harvard's Graduate School of Education (Harvard University, 2004–2007). River City uses a problem-based focus to engage middle school students in determining the cause of an epidemic in a 19th-century town. Each student participates in a collaborative team, controls an avatar that lives in the virtual city, and uses the computer to recommend solutions to the simulated health crisis (Dede, 2007; Harvard University and Arizona State University, 2004–2007). Data from the 1,000 students who participated in the project during 2004–2005 indicate that after 20 sessions, students' knowledge of biology improved 32–35% (Blaisdell, 2006). Preliminary results from Ketelhut, Dede, Clarke, and Nelson (2006) indicate that in addition to learning biology content, students' attendance improved, misbehavior decreased, and through this highly engaging activity, students were building virtual communication skills necessary for success in modern society. Use of this type of gaming activity changes classroom instruction from a lecture-based, teacher-driven method of delivery to an interactive delivery whereby students construct knowledge in small group activities through inquiry (Dede, 2007; Ketelhut et al., 2006). See Black and Steinkuehler (Chapter 18, this volume) for more on gaming and virtual spaces.

These observations suggest that educators must begin to find relevant ways to allow students to share their advancing technology skills within classroom settings. Teacher-designed assignments and projects can benefit from the inclusion of the rich multimedia technology present in students' external computing activities. Furthermore, educators can capitalize on student interest by using gaming scenarios within the classroom and allo the free flow of information and res through open-access publishing in b wikis, and through social networking si

Knowledge of the potential literacy mands of the future workforce is essenti educators develop instructional plans fo cluding technology in their classro Friedman (2006), in *The World Is Fla Brief History of the Twenty-First Cen* indicates that the world is becoming an e playing field due to global technological vances. There are four things that one m know to survive in the flat world. Citiz must learn to work well with others and velop a passion and curiosity for learning addition, Friedman suggests that succes individuals "need to learn how to learn" they are able to absorb new information a adapt to a changing, automated, and di tized world (p. 302). Historically, Americ society values skills such as sequencing a analysis that are used in left-brain activiti whereas in the 21st century, skills such emotional expression and synthesis will more useful. Schools typically reward lef brain activities, but in the flat world nurtu ing only the left brain will be insufficien Advances in computer technology and th rise in the outsourcing of jobs that use bas computing skills will require American stu dents to be able to think across discipline and creatively solve problems in order to maintain economic viability. Education itself will need to change to meet the demands of the flat world. For this reason, educators will need to be empowered to develop 21st-century literacy skills and teacher education programs will need revision to ensure that new literacy skills become part of teacher certification programs (New Media Consortium, 2005).

Although the current pace of technology use in the classroom has lagged behind student use outside the school environment, modern students are encouraging, nudging, and pushing educators to move into the 21st century as they bring their experiences and learning into the schoolhouse. The rest of this chapter describes digital literacy practices and instructional strategies for use within classroom settings, including research into areas such as hypertext, instant messaging, and writing in electronic environments. We must acknowledge that research

area of classroom applications of literand technology practices is limited, but nding rapidly (Dalton & Proctor, 2006). andow (1992) expressed, educators and nts alike "must abandon conceptual ms founded upon ideas of center, mar- hierarchy, and linearity and replace n with ones of multilinearity, nodes, s and networks" (p. 2). This change prondly impacts education as reading, writ- and viewing in digital, hypertextual enonments become the center of literacy ctices.

LASSROOM APPLICATIONS F DIGITAL LITERACIES

Many students feel that the literacy they lue in their everyday lives is not connected the literacy valued by their schools, and teachers in particular (Williams, 2005). eachers can find many ways to incorporate igital literacy that connects students' outsidechool literacy experiences to what they do n school, thus indicating in a powerful way hat these experiences are valued. Incorporating new literacy experiences can, in turn, lead to greater engagement by the students. In this section of the chapter, digital literacy and comprehension, reading critically, writing, and the impact on struggling adolescents are addressed.

Digital Literacy and Reading Comprehension

Most instruction and reading in school is done with paper-based texts when, in reality, most people read from a variety of texts, both paper-based and electronic (Gambrell, 2005). Students need instruction that incorporates reading electronic texts so that they are able to comprehend in digital environments as well as they do in traditional text. The methods they use may be similar to those they use in paper-based texts, but there are unique challenges when reading text in electronic environments. Just as Durkin (1993) asserts that "teaching students how to go about constructing meaning of connected text is the essence of comprehension instruction" (p. 36), it is essential now that teachers help students create understanding through digital literacy. Schmar-Dobler (2003) observed and interviewed adolescent online readers and found that they used the following comprehension strategies similarly when reading paper-based text and the Internet: (1) activating prior knowledge; (2) determining important ideas; (3) synthesizing; and (4) drawing inferences. Because of the volume of text on the Internet, she found the self-monitoring strategy of skimming and scanning was critical for success, as was the ability to ask oneself guiding questions to keep the reading focused. Whereas in print-based texts the reader has to navigate features such as headings and graphics, on the Internet the reader navigates features such as downloading and pop-up ads. To aid students in making adjustments to their comprehension when reading on the Internet, teachers can provide modeling and instruction to "begin to build the bridge connecting literacy and technology" (Schmar-Dobler, 2003, p. 85).

In research conducted by Coiro and Dobler (2007), sixth graders used traditional strategies to comprehend text in an open-ended information system (i.e., the Internet). However, while using prior knowledge, inferential reasoning, and self-monitoring, they were also utilizing skills that were unique to this electronic environment. For example, the participants not only used their prior knowledge of the topic and of informational text structures in paper-based texts, but they also used "their prior knowledge of informational website structures" (p. 230) and of Internet search engines. In terms of inferential reasoning, the participants "appeared to make forward inferences (e.g., predictions) within Internet text each time they were confronted with one or more hyperlinks on a given page" (Coiro & Dobler, 2007, p. 233). They also "engaged in a multilayered inferential reading process that occurred across the three-dimensional spaces of Internet text" (p. 234). One way in which self-monitoring was different when reading on the Internet was that physical actions were necessary in this electronic environment—clicking, typing, and scrolling. In addition, there was a difference in the speed at which the participants made choices when reading various Internet texts. The researchers found that the participants were able to make choices more quickly when reading the results in a search engine

than when reading hypertext in an informational website. This research supports the idea that students will use traditional comprehension strategies in electronic environments and that the strategies will also be adapted for that environment.

Just as every classroom includes students with a wide range of literacy abilities and experiences, the reality is that students also come to school with many different abilities and experiences with technology. Evans (2007) of NetDay indicates that the digital natives entering the classroom include students with a range of technological expertise; therefore, it is imperative that teachers spend instructional time interactively demonstrating the use of technology, including software programs and Internet websites (McKenna, Labbo, Reinking, & Zucker, 2007). Projecting an image of the computer screen to the screen in the classroom using an LCD projector is an efficient way to demonstrate how to use particular software for a certain purpose or navigate through the Internet to find information. Although some students may have great facility with various software programs or in using the Internet, when a teacher provides a targeted demonstration for an instructional purpose, the learning takes on new meaning for that particular topic or situation. The students are learning techniques that can be used at that time, as well as skills that can be transferred to other learning situations at a later time. Teachers can help students, as McKenna et al. (2007) note, to "create a rich schema for employing technology in ways that quite naturally involve many literacy-related activities" (p. 346). As teachers are interactively demonstrating the use of technology, they can also use think-alouds (i.e., saying out loud what one is thinking) to help students "think metacognitively about their information-seeking behaviors and processing of information gathered in online environments" (Kymes, 2005, p. 498). The combination of demonstrating interactively and conducting think-alouds can assist students in becoming successful in reading in an electronic environment.

Valmont (2003) asserts that in an electronic environment, students' comprehension is affected by both manipulation of the electronic text and the use they make of the information gained from the electronic text. He proposes that teachers conduct an electronic version of the traditional Directed Reading–Thinking Activity (DRTA) created by Stauffer (1969). In the traditional DRTA, teachers support students' reading of print-based texts by encouraging them to set purposes for reading and remain actively engaged while reading, by making and revising predictions before and during reading, and by synthesizing what happened in the text after reading. The same format can be followed by teachers and students reading electronic texts, both narrative and expository. When teachers encourage students to use the DRTA while reading texts in an electronic environment, they help students to set a purpose for active engagement in reading, that is, to become independent readers and thinkers.

The use of hypertext is a defining aspect of reading in electronic environments, especially on the Internet, that should be modeled by teachers. When reading hypertext, students must simultaneously navigate through multiple layers to construct their own unique text and monitor their own understanding of the reading. There can be many paths to create a text, where each reading may result in different information or the reader may come to a different understanding or conclusion. Lawless et al. (2003) describe three types of people who navigate hypertext. It is important that teachers understand these three types so that they can target their instruction to support students who fit each profile. "Knowledge seekers" try to find information by selecting links that will forward their goals. The "feature seekers" spend more time clicking on the links to see how the hypertext/hypermedia is organized than they devote to acquiring information. The "apathetic hypertext users" are not interested in gathering information or learning more about the hypertext links. Keeping these profiles in mind, one can clearly understand that students make decisions, while reading hypertext and hypermedia, that have a direct impact on comprehension.

Valmont (2003) states, "Comprehension is affected by the purposes students set for accessing, retrieving, and using information they obtain through electronic media as well as by their navigational and organizational abilities" (p. 93). Because navigating through

rtext and hypermedia is one of the chal- s of digital literacy (McKenna et al.,), students benefit from teachers' using CD projector to model how to maneu- round hypertext and conducting think- d sessions to demonstrate the thought esses that readers use when making de- ns about what path to take in their ing (Kymes, 2005). The "feature seek- and "apathetic hypertext users" need e guidance from teachers to learn how use hypertext and hypermedia to their advantage. Lawless et al. (2003) found when readers had greater domain knowl- e when reading hypertext, they were able be more efficient when selecting and se- ncing information and had better com- hension of text. Therefore, it is important teachers to continue to use instructional e to activate, assess, and build back- ound knowledge on a variety of topics. In dition, teachers can help students under- nd that it is important to independently ild their own background knowledge om a variety of sources before they read xts in an electronic environment so they ill have more success.

Teachers also support student learning hen they demonstrate the use of PowerPoint create reports or presentations that incor- orate a variety of media, such as graphics, ideo, and hyperlinks. This instruction can irectly impact students' use of technology or a project, such as the one described by Kinzer (2005) in which a student used PowerPoint to create a multimedia research resentation on Hinduism. The student used a combination of text and graphics to present her information, including a time line of im- portant dates in the history of Hinduism.

A critical component of comprehension requires students to synthesize and extend their understanding of what they read. In traditional paper-based formats, creating se- mantic networks or maps, sometimes called concept maps or mind maps, has been a great benefit to students' comprehension (Johnson & Pearson, 1984). Jonassen (2006) describes the construction of Mindtools models that are similar to semantic maps, to help students better learn material that can be presented in class or found in paper- based and electronic-based texts. If a student is trying to understand information found on the Internet, it makes sense for him or her to continue using the computer, instead of using paper, to create a model or representa- tion of that information to enhance under- standing. According to Jonassen (2006), "the semantic networks in memory and the maps that represent them are composed of nodes (concepts or ideas) that are connected by links (statements of relationships)" (p. 101). Readers can use the graphic tools found in many word processing programs to create a semantic network by placing the main concept in the middle of the computer screen with lines drawn to other related con- cepts to show relationships. In electronic en- vironments, the reader can include pictures, such as clip art, and other hypermedia to en- hance their understanding of concepts.

An important part of students' connecting to any type of text is for them to respond to it, which in turn, can enhance comprehen- sion. Allowing students to discuss what they are reading can be motivating for them (Guthrie & Wingfield, 2000). Carico and Logan (2004) and Grisham and Wolsey (2006) found positive results when teachers conducted online discussions to facilitate re- sponses to literature. In Carico and Logan's research project, university students part- nered with eighth graders to discuss books that both partners had read, providing a unique opportunity to interact. Online dis- cussions afforded anonymity to students who were usually quiet in class so that they and more vocal students had equal opportu- nities to share. Carico and Logan also found the following positive comprehension out- comes of the online discussions: (1) the par- ticipants helped each other by clarifying as- pects of the texts that were unclear; (2) they identified both plot elements and relation- ships; and (3) they made connections be- tween the book they read and other books. Grisham and Wolsey (2006) found that eighth graders involved in an online, threaded book discussion became more engaged as time passed. Owing to the asynchronous nature of the threaded discussions, the students thought "more deeply about their responses to the literature" (p. 656) and were thought- ful in their responses to the postings their peers made. Because the majority of adoles- cents are online, teachers can take advantage of using online discussions as a mode of communication to enhance comprehension and motivate student reading.

Critical Reading

There is a tremendous amount of information on the Internet. An important part of a teacher's job in the 21st century is to help students become critical readers of the information on the Internet. To be critical readers, individuals need to recognize their own prejudices and beliefs as well as the ways in which people persuade readers to think a particular way or to do something they may not otherwise do (Valmont, 2003). Teachers need to be clear with their students that they should take a stance of skepticism about the information they read, because they will likely find misinformation on the Internet. Part of what a teacher needs to do is help students to be aware of the authors of websites, including their credentials and possible motives. According to Valmont (2003), students can be taught to ask the following questions: What is the purpose of the website? What authority does the author have to present the information? What is the tone of the author's message? To help make these issues clear to students, teachers can show examples of propaganda on websites. For example, there is a website on Martin Luther King Jr., *www.martinlutherking.org*, that might at first seem to be a viable website with information about the civil rights leader's life; however, the website was created by a White supremacist group (Holschuh, 2006). Valmont (2003) also addresses the need for teachers to help students become critical of online advertisements. Students need to understand that there are keywords, attention grabbers, and ways to lure people to do something, which intentionally manipulate readers of online advertisements. In the 21st century, if adolescents do not have guidance to learn to be critical consumers of information and advertisements on the Internet, the consequences are serious. Adolescents can have their identities stolen if they provide their credit card numbers to lurking predators or can commit a violation of academic integrity by cutting and pasting information that is not their own.

Digital Literacy and Writing

When teachers decide to incorporate digital literacy into their teaching, especially their writing instruction, a first step is to provi time for metadiscussions of the students' i school and out-of-school literacy practic (Lewis & Fabos, 2005). Williams (200 suggests that teachers can discuss with th students how these literacy practices diff and how and why their out-of-school exp riences are more engaging. The discussio can lead to an understanding by studen that what they do outside school and ho they do it can have a viable application i school. For example, Lewis and Fab (2005) analyzed the instant messaging pra tices of adolescents and found that th "used language in complex ways in order t negotiate multiple messages and interweav these conversations into larger, overarchin storylines" (p. 482). During the discussion suggested by Williams (2005), students ca make connections between the skills th use when they are instant messaging the friends, such as their ability to change the voices, depending on their audience, an transfer the skills to how they create a stor in their creative writing class (Lewis & Fabos, 2005).

An efficient way to combine technolog and writing is to allow students to mov through the writing process (i.e., prewriting drafting, revising, editing, and publishing on the computer (McKenna et al., 2007) Russell and Plati (2000) found that 20% more students would pass the state-man dated writing tests if they could use the com puter. Goldberg, Russell, and Cook (2003) conducted a meta-analysis of research on th effects of computers on writing. They found the following results, favoring students who wrote on the computer as compared with students who wrote with paper and pencil (1) students wrote more; (2) students' writ ing was of a higher quality; (3) students made more changes to their writing; (4) stu dents engaged in more collaboration; (5) the writing process was used in a less linear way and was more integrative; (6) students were more motivated; (7) students improved their literacy skills, attitudes, and higher-level thinking skills.

Publishing is an integral part of the writ ing process, and technology, especially the Internet, has opened a whole new world of possibilities for getting students' writing published. Whereas in the past, the publish ing of students' work was limited to the

ssroom or school, now students' work be published on the Internet with the tential of being read by people all over the rld (Bruce, 2002). Students then have an egral, real connection to the global com- unity. Bruce further asserts, "As communi- s develop through shared literacies, they nstruct technologies that reflect their col- ctive extraction of meaning from experi- nce" (p. 15). Chamberlain (2005) suggests hat teachers can create a website in which heir students' writing is published; she even oes a step farther to suggest the idea of cre- ting online portfolios in which students have a collection of their writing on their own webpages within the class website. In this model, the teacher needs to establish high expectations for the writing that students include in their online portfolios, especially because their work has the potential to be read by millions of people. Chamberlain (2005) also notes that it is crucial that, for safety's sake, students not use their full names when publishing their work on the Internet.

Incorporating digital literacy into the classroom can have important benefits by providing socially meaningful experiences for students. Because adolescents are already using e-mail and blogs as ways to communicate outside school (Williams, 2005), it makes sense to find instructional uses for them in school. For example, Keypals are Penpals in which the pals communicate through e-mail instead of traditional letters that move through snail mail (Kinzer, 2005). Connecting students to Keypals in other parts of the community, state, country, or even other countries, is a quick, powerful way for students to feel they are part of the global community. There are many ways to use Keypals for students to learn about a variety of topics, such as the customs, traditions, and living conditions in places other than their own communities. Garner and Gillingham (1996) describe messages that were exchanged through the Internet between students in Joliet, Illinois, and students in Tununak, Alaska, in which the students discovered and were able to dispel cultural misunderstandings of stereotypes. For example, the students in Alaska assumed that violent crime was a daily occurrence for people in the mainland United States. Christian (1997) documents another example of students connecting through e-mail to discuss a book. He met with teachers from around the United States who became involved in a project in which their middle school students discussed *Anne Frank: The Diary of a Young Girl.* A great benefit of Keypals over traditional Penpal arrangements is that communication is quick; students can get responses within minutes or hours.

Blogs, short for *weblogs,* can serve similar purposes as Keypals, but the audience is much larger, potentially including millions of people. Keypal relationships can be more personal, whereas blogs can connect students to a larger audience. Huffaker (2005) states, "Any discipline can use blogs to approach a style of *meta-learning,* where concepts or contexts are discussed and articulated in both a personalized and group exchange, and ideas are built on previous educational content" (p. 95). Williams (2005) suggests using transcripts of e-mail and other online communication for instructional purposes in another way. Teachers can have students rewrite their online communication in different genres "to help make them more aware of how genre influences what information we choose to provide and how we choose to provide it" (p. 706). This connects adolescents' outside literacy lives to their school lives.

Multimedia book reviews are similar to the traditional book reports that are completed in thousands of classrooms in thousands of schools. According to Reinking and Watkins (2000), the differences between multimedia book reviews and traditional book reports are that multimedia book reviews (1) allow students to use computers to include graphics and sound to enhance their textual information about a book; and (2) can be shared with more people than the students in a classroom because they can be posted on the Internet, making the reports available to a wider audience. Reinking and Watkins (2000) found that students who were involved in creating multimedia book reviews became more engaged in literacy-related activities and that these projects especially increased independent reading. They also found a secondary benefit to the use of multimedia book reviews: The students and teachers enjoyed learning the technology to create the reviews. This benefit indicates

that "various curricular goals can be advanced by embedding relevant content within technologically challenging and engaging tasks" (p. 411).

Digital Literacy and Struggling Adolescents

A key issue in working with adolescents who are struggling with reading and writing (i.e., read and write below grade level) is finding materials that can motivate them to work on the specific skills that need improvement. Anderson-Inman and Horney (1998) describe the ways that technology can be used to support struggling students as they read text that has been electronically changed to support the reader's needs. As a student reads on the computer and comes to a word or phrase that is difficult, the altered version provides sound or graphics to help the student read the text and proceed with greater comprehension. Anderson-Inman and Horney (1998) discuss thoroughly the research that found positive effects when providing struggling readers with supported text. Dalton and Strangman (2006) add to this discussion with a review of the research that indicates how electronically supported text helps struggling readers with decoding and fluency and directly impacts comprehension. This research indicates that struggling adolescents, especially those who are significantly below grade level, can benefit from reading electronically supported text.

CONCLUSION

The use of digital literacies in adolescent life is complex. There are multiple definitions of 21st-century literacy and a variety of ways to view the interaction between literacy and technology. Rapid changes in 21st-century literacies create additional challenges as research reported in print environments tries to keep up with the pace of technological advances. These challenges indicate a crucial need for teachers in the 21st century to merge adolescents' outside-the-classroom use of technology with the literacy practices of the school. This chapter has explored various viewpoints regarding the changing definitions of literacy and the reading and writing instructional activities that support use of new technologies in the classroom. In t case, it is clear that the importance of di literacies in the 21st century, as well as nudging of our adolescents, will continu expand and impact our classroom inst tion for the foreseeable future.

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