What Is New About The New Literacies of Online Reading Comprehension?

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Change defines literacy (Coiro, 2003; Hartman, 2000; Leu, 2000; Rosenblatt, 1938). Our lives change in fundamental ways as we become literate, expanding access to information, communication, and action (Freire, 1972, 1985; LeVine, LeVine, & Schnell, 2001).

Because understanding change is at the core of what we do, it is ironic that our research community has largely ignored the extensive changes to literacy taking place in a digital, networked, multimodal, and multitasking world of information and communication. The nature of literacy is undergoing profound change, and we have little research or solid theory to inform our understanding of the consequences for classroom practice (Reinking, 1998).

New information and communication technologies (ICTs), such as the Internet (Leu, 2000), wikis (Thomas, in press), blogs (Mortensen, in press), search engines (Henry, 2006), instant messaging (Jacobs, in press; Lewis & Fabos, 2005), email (Tao & Reinking, 2000), online gaming worlds (Steinkuehler, in press) require new literacies and have become important new contexts for literacy, learning, and life (International ICT Literacy Panel, 2002). Few, if any, of these new literacies have found their way into the classroom (Cuban, 2001; Madden, Ford, Miller, & Levy, 2005). Indeed, many seem to be resisted overtly, by deliberate educational policies (Leu, 2006), or covertly, by educators who sometimes are not nearly as literate with the Internet as the students they teach (Chandler-Olcott & Mahar, 2003).

The irony of ignorance may be greatest in research on reading comprehension. Although we are beginning to establish extensive theoretical and research literatures on the reading comprehension of traditional texts to inform practice (Biancarosa & Snow, 2004; Kamil, Mosenthal, Pearson, & Barr, 2000; National Institute of Child and Human Development [NICHD], 2000; RAND Reading Study Group [RRSG], 2002), there is hardly any research on the nature of reading comprehension on the Internet or with other ICTs (Coiro & Dobler, 2007). The assumption appears to be that reading comprehension is fully isomorphic—offline and online.

Both speculation (Coiro, 2003; RRSG, 2002; International Reading Association [IRA], 2001) and emerging research (Coiro & Dobler, 2007; Coiro, 2007; Leu et al., 2005) suggest that this assumption is misplaced. As The Rand Reading Study Group [RRSG](2002) concluded, ". . . 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).

We have failed, however, to provide the educational community with adequate research and theory on the new literacies of reading comprehension on the Internet (Coiro, 2003). That failure has important consequences for education in the twenty-first century, when learning is increasingly dependent on the ability to read and comprehend complex information at high levels (Alexander & Jetton, 2000; Bransford, Brown, & Cocking, 2000), and the Internet is now a central source of that information (Lyman & Varian, 2003). As a result of our collective failure, many students go unsupported in developing the new literacies of online reading comprehension in school (Castek, Leu, Coiro, Gort, Henry, & Lima, in press; Leu, 2006), especially those students who require our support the most—those who have access to the Internet at home the least.

What is new about these new literacies? The answer to this question is only beginning to emerge. We are hampered by a confusing series of overlapping constructs (Coiro, Knobel, Lankshear, & Leu, in press), a limited body of research (Leu, 2006), and very few scholars who study the issue (Hartman, 2004). Moreover, the continuously changing nature of ICTs suggests that even newer literacies will be required from even newer technologies appearing tomorrow, next month, and next year (Leu, 2000). Thus, a complete understanding of new literacies may be a Sisyphean task, never fully attainable.

The Internet Is a Defining Technology for Literacy and Learning in the Twenty-First Century
We recently passed an important milestone in the history of literacy: in late 2005, the one-billionth individual started reading online (de Argaez, 2006; Internet World Stats: Usage and Population Statistics, n.d.). The rate of this growth has been exponential; most of it has taken place in the past five years (Global Reach, n.d.). In the history of literacy, no other technology for reading, writing, and communication has been adopted by so many people, in so many places, in so short a time.

While the Internet fills important personal needs, much of the increase in Internet use has been driven by changes taking place in the workplace. Economic units have had to increase productivity in a globally competitive economy (Friedman, 2005). As a result, the world of work has recently undergone fundamental restructuring (Bruce, 1997; Drucker, 1994; Gilster, 1997; Mikulecky & Kirkley, 1998; New London Group, 2000).

Traditionally, industrial-age organizations were organized vertically. Decisions were made at the highest levels and then communicated to lower levels, where they were simply carried out without the need for much thought by bottom-tier employees. This wasted much of the intellectual capital within an organization, limiting productivity (New London Group, 2000).

With restructuring, workplaces have sought to achieve greater productivity by organizing themselves horizontally, empowering teams within lower levels of an organization to make important decisions related to their work (Mikulecky & Kirkley, 1998; New London Group, 2000). Members of these teams must identify important problems, locate useful information related to the problems they identify, critically analyze the information they find, synthesize this information to solve the problems, and then quickly communicate the solutions to others so that everyone within the horizontally structured organization is informed. By requiring all employees to use their ability to read, communicate, and solve problems, economic organizations have increased productivity, allowing some to flourish within intense global competition (Friedman, 2005).

Given these changes, it is no accident that the Internet has rapidly appeared in the workplace; it permits access to the information required to increase productivity (U.S. Department of Commerce, 2002). Of course, using the Internet to take full advantage of the intellectual capital of each employee has also altered the literacy demands of the workplace (Leu, Kinzer, Coiro, & Cammack, 2004; Mikulecky & Kirkley, 1998). Employers now seek individuals who know how to read, write, and communicate on the Internet to solve problems.

These changes are not insignificant. In just one year (August 2000 to September 2001), use of the Internet at work to read, write, and communicate increased by nearly 60 percent among all employed adults twenty-five years of age and older (U.S. Department of Commerce, 2002). Moreover, recent economic data demonstrate the extent to which this restructuring, Internet integration, and changes in literacy practices account for productivity gains during the past decade in the United States, Europe, and other nations (van Ark, Inklaar, & McGuckin, 2003; Matteucci, O'Mahony, Robinson, & Zwick, 2005).

The Internet has also quickly found its way into homes in the United States and other nations. In 2004, nearly 75 percent of all households in the United States had Internet access (Nielson/NetRatings, 2004). Usage is especially frequent among adolescents. Eighty-seven percent of all students between the ages of 12 and 17 in the United States report using the Internet, nearly 11,000,000 daily (Lenhart, Madden & Hitlin, 2005). Similar changes have occurred in other developed nations, some of which are far ahead of those in the United States. In Japan, for example, Bleha (2005) reports that 98 percent of all households have Internet access via broadband that is sixteen times faster than in the United States.

During the past decade, integration of the Internet into school settings has also been rapid. In 1994, only 3 percent of all K–12 classrooms in the United States had Internet access; today, 93 percent have access (Parsad & Jones, 2005). Of course, increasing Internet access does not necessarily mean that students are being taught the skills necessary to locate, read, and think critically about online information. Indeed, while there is nearly ubiquitous Internet access in U.S. classrooms, new technologies such as the Internet are not often integrated into instruction (Cuban, 2001; Madden et al., 2005).

It is clear that the Internet is this generation's defining technology for literacy and learning, It is also clear that classrooms have yet to take up Internet integration systematically, let alone instruction in the new literacies the Internet requires. In fact, those pioneering teachers who have led the way with Internet integration focus on the technology aspects of use, not seeing the this as an instructional issue for literacy at all (Karchmer, 2001).

New Literacies, ICT Literacy, and Information Literacy as Contested Theoretical Space

Several research communities have begun to explore the changes to literacy created by new technologies and the social practices they engender. Scholars from disciplines such as cognitive science (Mayer, 2001), sociolinguistics (Cope & Kalantzis, 2003; Gee, 2003; Kress, 2003; Lemke, 1998), cultural anthropology (Markham, 1998; Street, 2003; Thomas, in press), and information science (Bilal, 2000; Hirsch, 1999) have identified changes to literacy as they study the consequences for their individual areas of study. As many new heuristics appear, informing this multidisciplinary work, a new perspective about the nature of literacy is beginning to emerge. This perspective, often referred to as "new literacies," is still in its initial stages, but it is clear to most that it will be a powerful one, redefining what it means to be literate in the 21st twenty-first century (Lankshear & Knobel, 2003; Leu, et. al., 2004).

"New literacies" is highly contested space, however; the construct means many things to many people. To some, new literacies are new social practices (Street, 1995; 2003) that emerge with new technologies. Others see new literacies as important new strategies and dispositions, required by the Internet, that are essential for online reading comprehension, learning, and communication (Coiro, 2003; Leu, et. al., 2004). Yet others consider new literacies to be discourses (Gee, 2003) or new semiotic contexts (Kress, 2003; Lemke, 2002) made possible by new technologies. Still others see literacy as differentiating into multiliteracies (New London Group, 2000) or multimodal contexts (Hull & Schultz, 2002), or view new literacies as a construct that juxtaposes several of these orientations (Lankshear & Knobel, 2003). When these uses of "new literacies" are combined with an earlier use of the term by the New Literacies Study Group and with terms such as ICT Literacy (International ICT Literacy Panel, 2002) or informational literacy (Hirsch, 1999; Kuiper & Volman, in press; Webber & Johnson, 2000), the construct becomes even more challenging to understand. However, most would agree there are at least four defining characteristics of an emerging new literacies perspective.

First, new technologies for information and communication and new envisionments for their use require us to bring new potentials to literacy tasks that take place within these technologies. Although they may differ on which construct they use, each set of scholars would probably agree that the Internet and other new ICTs require new skills, strategies, and dispositions for their effective use.

Second, new literacies are central to full civic, economic, and personal participation in a globalized community. As a result, they become important to study so that we might provide a more appropriate education for all of our students.

Third, new literacies are deictic (Leu, 2000); they regularly change as defining technologies change. The new literacies of the Internet and other ICTs are not just new today; they will be newer tomorrow, even newer next week, and continuously renewed on a schedule that is limited only by our capacity to keep up. Of course, literacy has always changed as technologies for literacy have changed (Manguel, 1996). What is historically distinctive is that, by definition, the Internet permits the immediate, nearly universal, exchange of new technologies for literacy. With a single click, a new technology such as Wikipedia may be distributed to everyone who is online. Thus, what may be important in reading instruction and literacy education is not to teach any single set of new literacies, but rather to teach students how to learn continuously new literacies that will appear during their lifetime.

Finally, new literacies are multiple, multimodal, and multifaceted. Thus, they increase the complexity of analysis that seeks to understand them and benefit from analysis that brings multiple points of view to understand them (Labbo & Reinking, 1999). This may also suggest that the area is best studied within interdisciplinary teams, as questions become far too complex for the traditional, single-investigator model (Coiro, Knobel, Lankshear, & Leu, in press).

Toward an Understanding of the New Literacies of Online Comprehension

The lack of theory and research on the new literacies of online reading comprehension is surprising, given the increasing prevalence of the Internet in our lives. It suggests that our field assumes isomorphism between online and offline reading comprehension. Initial studies, now beginning to emerge, challenge this assumption. One study, among highly proficient sixth-grade students (Coiro & Dobler, 2007), found that online reading comprehension shared a number of similarities with offline reading comprehension—

but also included a number of important differences. A second study (Leu et al., 2005) found no significant correlation, among seventh-grade students, between performance on a measure of offline reading comprehension and a measure of online reading comprehension for adolescents, using a blog to provide prompts and record responses (ORCA-Blog). The ORCA-Blog measure demonstrated good psychometric properties. These results also suggest that new skills and strategies may be required during online reading. A third study (Coiro, 2007), using a regression model, found that—although offline reading comprehension and prior knowledge contributed a significant amount of variance to the prediction of online reading comprehension—additional, significant variance was contributed by knowing students' ability in online reading comprehension. The results of this study are also consistent with the conclusion that new skills and strategies are required during online reading comprehension.

Additional research is now taking place on several, federally-funded research grants in the United States. One of these, the Teaching Internet Comprehension to Adolescents (TICA) Project (Leu & Reinking, 2005), explores the skills and strategies that proficient online readers at the seventh-grade level report during online reading comprehension. The project website is available at: http://www.newliteracies.uconn.edu/iesproject/

The initial model of online reading comprehension informing this work (Leu, et. al, 2004) proposes preliminary answers to two questions essential to a theory of reading: What must students acquire to become proficient at online reading? How do students acquire these skills, strategies, and dispositions?

What Must Students Acquire to Become Proficient at Online Reading?

Models of comprehension have traditionally focused their attention on processing internal to the reader, describing major cognitive and linguistic sources of knowledge (metalinguistic, discourse, syntactic, vocabulary, decoding, etc.) and how each functions during comprehension processing. They have not always situated the reading process in the social practices, texts, or contexts that drive the reading act (Coiro, 2003; RRSG, 2002).

Recent work on online reading comprehension (e.g., Coiro & Dobler, 2007; Henry, 2005; Castek, Leu, Coiro, Kulikowich, Hartman, & Henry, 2006; Leu, Kinzer, Coiro, & Cammack, 2004; Leu & Reinking, 2005) expands on traditional comprehension models to include the purposes that drive online reading, the communicative outcomes of online reading, and the continuously changing nature of the skills, strategies, and dispositions that are required during online reading comprehension. This perspective views reading comprehension on the Internet as contextually situated in both purpose and process:

> The new literacies of the Internet and other ICT 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 ICT 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. (Leu, Kinzer, Coiro, & Cammack, 2004, p. 1570)

Within this perspective, new literacies of online reading comprehension are defined around five major functions: 1) identifying important questions; 2) locating, information; 3) analyzing, information; 4) synthesizing information; and 5) communicating information. These five functions contain the skills, strategies, and dispositions that are both distinctive to online reading comprehension and, at the same time, appear to overlap somewhat with offline reading comprehension. What is different from earlier models is that online reading comprehension is defined around the purpose, task, and context as well as the process that takes place in the mind of the reader. Readers read in order to find out answers to their questions on the Internet. Any model of online reading comprehension must begin with this basic observation.

Identifying Important Questions.
We read on the Internet in order to solve problems and answer questions that are both large (e.g., "How do we create a better climate for peace in the Middle East?") and small (e.g., "What is the best price for a flight from New York to Orlando on December 21?"). Indeed, the fact that online reading comprehension always begins with a question or problem may be an important source of the differences between online and offline reading. Recent work within traditional texts by Taboada and Guthrie (2006) suggests that reading initiated by a question or problem differs in important ways from reading that does not.

Locating Information
Because the Internet contains vast amounts of information, it requires new online reading comprehension skills and strategies to locate pertinent information (Henry, 2006). Thus, we include in our model of online reading comprehension the strategies that readers use with a search engine—strategies studied by scholars in information science and library and media studies (e.g., Bilal, 2000) and often included by library media specialists in their work on information literacy.

Our initial work has revealed at least four general types of reading skills associated with the location of information on the Internet: 1) knowing how to use a search engine to locate information; 2) reading search engine results; 3) reading a Web page to locate information that might be present there; and 4) making an inference about where information is located by selecting a link at one site to find information at another site. Often, these skills intersect. Each requires additional new comprehension strategies that become important while reading online.

The ability to locate information on the Internet is essential to online reading (International ICT Literacy Panel, 2002). Knowing what to look for and how to access task-relevant information on the Internet is not intuitive; it involves a complex set of skills for which many students are not always adequately prepared (Bilal, 2000; Nachmias & Gilad, 2002). Henry (2006) describes the location of information as an important "gatekeeper" skill that largely determines the effectiveness of online reading comprehension.

Perhaps the easiest way to observe the importance of these online reading comprehension skills is to observe adolescents reading the results page from a search engine such as Google. Most do not actually read the items on the results page. Instead, the majority use a simplistic "click and look" strategy. They begin at the top of the list, clicking on each result and quickly viewing the image at each Web page that appears to see if its visual appearance matches their needs (Guinee, Eagleton, & Hall, 2003; Henry, 2006). Indeed, they do not even appear to "read" any of the search result descriptions as they work their way down the list of search engine results. Knowing how to read search engine results often discriminates between good and poor online readers.

Critically Evaluating Information
Critical analysis and evaluation are skills that we want all readers to acquire, for offline and online texts alike. Our work with more proficient online readers in urban and rural classrooms (Leu, 2006) shows that students are frequently fooled about the reliability of the information they locate, even when they know that they cannot trust information on the Internet. Despite telling investigators that one should not trust the information on the Internet, a majority of proficient online readers in this study thought that a spoof site, *Save the Pacific Northwest Tree Octopus* (http://zapatopi.net/treeoctopus/), provided reliable information.

Coiro (2007) has found at least five different types of evaluation that occur during online reading comprehension:

      1) Evaluating understanding: Does it make sense to me?
      2) Evaluating relevancy: Does it meet my needs?
      3) Evaluating accuracy: Can I verify it with another reliable source?
      4) Evaluating reliability: Can I trust it?
      5) Evaluating bias: How does the author shape it?

Of course, each of these also takes place in offline environments. Some aspects of online evaluation, however, require new skills and strategies because of the new ways in which information is presented on the Internet.

For example, it is important to know how to evaluate search engine results in order to decide which website to visit first. Was the site created by an organization (.org), a company (.com), an academic institution or school (.edu), or by some other group or individual? After the decision about which site to investigate, critical evaluation continues. Where should I go to determine who is the author? What is his or her background? How does the author shape the information that he or she provides on the Internet? Do any other sites corroborate this information? We want our students to become healthy skeptics as they ask these and many other questions while reading on the Internet. Analysis and evaluation become especially important online because anyone may publish anything on the Internet.

Synthesizing Information

Although we have found synthesis to be a central component of online reading comprehension, we have also found it to be the most challenging one to study. Much of synthesis takes place in the mind of the reader. The process happens quickly and is not usually visible, so it is extremely difficult to observe in ways that provide visible patterns.

As they seek answers to questions and solve problems, online readers synthesize texts in at least two ways. First, of course, they synthesize the meaning of the texts, as they do with offline texts, putting together an understanding of what they have read. In addition, however, online readers synthesize texts in a second way: they actively construct the texts that they read through the choices they make about which sites to visit, which links to follow, whom to communicate with, and whose messages to read as they seek answers to the questions that direct their online reading. No two readers construct the same physical text online, even though they may have the same question or problem to solve. While choosing texts to read occurs offline, of course, it does not happen to nearly the same extent, with nearly the same speed, or with units of text that are nearly so short. Intertextuality (Hartman, 1995) defines online reading; far too often, it is merely a possibility offline in school classrooms. We are in need of much more work on the intertextual synthesis of meaning that occurs online.

Communicating Information

Many new communication tools become available on the Internet, each with its own affordances and each developing its own social practices. Thus, each tool requires its own set of strategies. Because reading and writing become fused in this fashion on the Internet, we have included communication within our comprehension model. Email, instant messages, chats, blogs, wikis, discussion boards, and phone and video conferencing are just a few of the tools that individuals use to read and comprehend information on the Internet today.

How Do Students Acquire Skills, Strategies, and Dispositions for Online Reading Comprehension?

How to support students in acquiring the new literacies of online reading comprehension is also little understood. Several observations suggest, however, that these are likely to be acquired best through social exchange and construction rather than formal, direct instruction. Because literacy is deictic (Leu, 2000), no individual, such as a teacher, can keep up with the many new literacies that rapidly and continuously appear online. Instead, each of us has to depend on others to help us acquire the continuously updated literacies of online reading comprehension. One person may know a useful strategy with Google, but another may know an equally useful strategy to communicate information at a wiki.

In the past, instruction has been based on the assumption that teachers were always more literate than students. This assumption is no longer true. The odds that teachers are less literate than the collective knowledge that exists in a single classroom increase as these new literacies become multiple (New London Group, 2000). As ever newer literacies appear and fragment our literacy landscape, it should be increasingly expected that at least one student always knows more than any teacher about some aspect of online reading comprehension. New models of instruction need to take advantage of this intellectual

capital that will be increasingly distributed around a classroom—the new literacies that students possess and that teachers may not.

This speculative analysis does not, of course, suggest that teachers will become less important in future classrooms. Indeed, just the opposite will be true. Teachers become more important, although their role changes, within new literacy classrooms. The more socially mediated learning aspects of online reading comprehension create more complex contexts that must be more thoughtfully orchestrated by teachers so that all of the students can bring their special insights about new literacies to the learning task.

Isomorphic and Nonisomorphic Examples of Offline and Online Reading Comprehension

What does online reading comprehension look like? In this section, we briefly describe the reading episodes of three seventh-grade students completing the same set of online reading tasks. To evaluate the extent to which online and offline reading comprehension are isomorphic, we compare their online performance with their levels of offline reading proficiency. To sustain an isomorphic hypothesis, students' online levels should match their offline levels.

The common set of tasks in these videos required students to read three blog entries, each of which contained a request for assistance in an attached Word document that needed to be downloaded. The first blog request asked students to locate two sites, given partial information about each, and post the URLs and the titles of these sites at the blog and then evaluate the two sites, according to a given set of criteria, and determine which one was best, explaining why. The second blog request asked students to locate a site on the Internet with an animated graphic that met several criteria, communicate the name and URL on the blog of the best animated graphic of the digestive system that they had located, and communicate how one should check the accuracy of information at an Internet site such as this one. The third blog request asked students to complete an activity similar to the second one, but to locate and evaluate the best animated graphic about the respiratory system. They were also asked to communicate additional ways to evaluate information on a site such as this for accuracy. You can view these videos of online reading at http://www.newliteracies.uconn.edu/reading.html. They show the complex ways in which elements of online reading intersect, revealing aspects of: question identification, location, evaluation, synthesis, and communication.

The Isomorphic Reading Hypothesis: Riko, A Student Displaying Proficiency in Both Offline and Online Reading

Riko is an example of a high-achieving offline reader who also is highly proficient with online reading comprehension. His example supports the prevailing assumption that online and offline reading are the same. This hypothesis predicts that high-achieving offline readers should also be high-achieving online readers and that low-achieving offline readers should also be low-achieving online readers. Subsequent cases raise questions about this belief.

Offline Reading Level. Riko's science teacher reports that he is an outstanding offline reader, able to read and understand a challenging seventh-grade science text with little assistance from a teacher. This evaluation was sustained by his score on the reading portion of the Connecticut Mastery Test (CMT). Riko achieved a total raw score on the CMT of 305. This falls in the range characterized as "advanced." Riko is an excellent offline reader.

Online Reading Level. In addition to doing well on the state reading assessment, Riko also did well on the ORCA-Blog assessment of online reading comprehension (Leu et al., 2005). Among eighty-nine students, Riko achieved the highest raw score, 30 out of 33. Viewing the video of Riko's online reading, you can see a high level of performance on a number of intersecting elements that are essential to online reading comprehension: locating, evaluating, and synthesizing information, as well as communicating.

While locating information, you see Riko try first to locate the Human Anatomy Online site using a search strategy commonly seen in lower performing online readers, that is, by simply typing in the name of the site he was asked to find plus the ending ".com." (He mistakenly types in www.humananatomy.com but is blocked by the school filter to this location.) Then, however, he shifts to

a search engine and quickly locates the site that was requested, *Human Anatomy Online* (http://www.innerbody.com/htm/body.html).

In terms of evaluation, the tasks in these videos tend to focus primarily on the evaluation of understanding, relevancy, and reliability. On each of these three aspects of evaluation, Riko performs well: he often rechecks his understanding of the document containing the request. He also evaluates sites for relevancy, and he communicates the strategies that he recommends to evaluate reliability.

In both synthesis and communication, Riko performs well. He correctly synthesizes information and clearly communicates it in his blog postings. This blog may be a new Internet context, but Riko appears to figure things out nicely, even when problems appear.

In short, this video shows that Riko is able to traverse effectively a complex set of informational windows and complete the reading tasks successfully . Riko's performance in online reading is what one would expect if online and offline reading were the same.

**The Nonisomorphic Hypothesis: Tomas, a Low-Achieving Offline Reader but a High-Achieving Online Reader**

Tomas provides an example you would not expect to find if online and offline reading were isomorphic. He is a very weak offline reader, being provided with supportive services as a student with a specific learning disability in reading. Surprisingly, however, he was among the top 15 percent of online readers in our sample.

Offline Reading Level. Tomas's science teacher reports that he was a very weak offline reader; seventh-grade science books were too difficult for Tomas to read, even with significant instructional support. His below-level reading skills were a documented component of his specific learning disability. He received daily instructional support from a trained special educator, who worked closely with all of his teachers to develop modified assignments and provide simplified instructional materials. His score on the recent CMT sustained this evaluation. Tomas's total raw score of 167 fell in the range characterized as "below basic."

Online Reading Level. Although Tomas performed poorly on the state reading assessment, he performed at a high level on the ORCA-Blog assessment of online reading comprehension. Among 89 students, Tomas achieved the tenth highest raw score, 22 out of 33. (As in all other assessment settings, Tomas was provided with additional time to complete the online assessment. He was given about 40 minutes instead of 30.) The video shows his successful performance on each of the three tasks, including slow, but very skilled patterns on a number of intersecting elements: locating and synthesizing information and communicating. Tomas did less well during the evaluation of information.

Although Tomas is slow, it is immediately apparent that he makes strategic and thoughtful decisions while reading online. He carefully organizes multiple windows so that he can traverse quickly between the task description and the search engine. He also enters appropriate key words for each search. In addition, he reads each list of search engine results, usually selecting the correct site. He also knows how to copy and paste the URL for a site into the blog to communicate the location. He uses thoughtful online reading strategies to locate graphics for digestive and respiratory systems, although, perhaps because of a vocabulary issue, he may not have understood what the word "animated" meant. Tomas also figured out the skills required to use this blog. He downloaded each document and posted entries for each of the three tasks. His communication skills, with the exception of some spelling issues, seemed quite adequate.

Figure 1. A video recording of the online reading comprehension performance by the weakest reader among 89 seventh-grade students. This student was among the highest achieving online readers. View this video at www.newliteracies.uconn.edu/reading.html
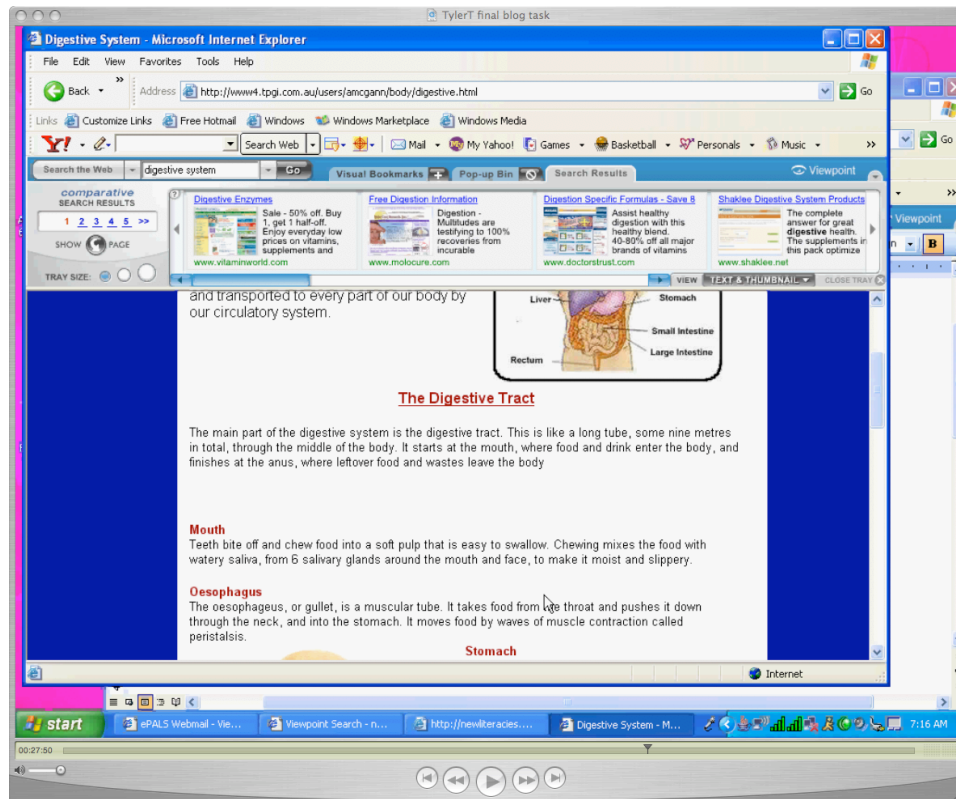
Tomas's weakest area of online reading comprehension was critical evaluation. Note, for example, the final entry about evaluation that he posted on the blog: "I don't think it mater who made the site aslong as it was good information and no adervertisment i don't think you need who made the site." Ignoring the spelling mistakes, we see that Tomas is somewhat naive and not fully aware of how people inevitably bias the information they provide to readers on the Internet.

Despite the more limited understanding of critical evaluation skills, this was not a performance one would expect from a student at a "below basic" level who requires instructional support for any assignment in class using offline materials. It suggests that readers who struggle with offline materials may not struggle with online materials to the same extent, as long as they have the skills and strategies essential to online reading comprehension.

The Nonisomorphic Hypothesis: Marcos, a High-Achieving Offline Reader but a Low-Achieving Online Reader

Marcos also provides an example you would not expect to find if online and offline reading were isomorphic. He is a high-achieving offline reader, but a surprisingly low-achieving online reader. His case also provides evidence of additional new reading comprehension skills required during online reading comprehension.

Offline Reading Level. Marcos's science teacher reports that he is an outstanding offline reader, able to read independently and understand a challenging seventh-grade science text. His score on the

CMT sustained this evaluation; Marcos's total raw score of 302 characterized him as "advanced." Marcos, like Riko, is an excellent offline reader.

Online Reading Level. Marcos did not perform well on the ORCA-Blog assessment of online reading comprehension. Among 89 students, Marcos achieved a raw score of 7 out of 33, in the bottom quartile of all online reading comprehension scores.

Comparing Marcos's online performance to Tomas's reminds us of the classic story of the tortoise and the hare. Although Tomas read slowly, he outperformed Marcos with his steady pace because he knew effective strategies for completing the tasks. Tomas located information efficiently and completed all three tasks. Marcos, on the other hand, moved quickly among sites, taking short cuts that hurt his performance. Because he had a difficult time returning to sites he had visited and because he did not know how to copy and paste a URL, he made many errors and, ultimately, ran out of time, failing to complete the third task. Distracted by his inability to locate items, he failed to include the title of the sites in his answers. Finally, because he could not return to some of the sites, he appears to have made up some of his evaluation comments. It looks as though Marcos has some online reading skills but is missing other crucial ones. As a result, he ends up being inefficient during online reading.

What Do These Videos of Online Reading Comprehension Reveal?

These examples teach us several important lessons. First, they reveal that online reading comprehension is typically organized around several elements that often occur simultaneously or recursively. In each video, we see how online reading often begins with a question or a problem and contains elements of locating, evaluating, synthesizing, and communicating that define online reading comprehension.

Second, these examples also illustrate how online reading is, typically, the reading of informational texts, not the reading of narrative texts. The Internet is a major new source of information that can be used to solve problems and answer questions. Online reading comprehension is the comprehension of informational text for learning and discovery.

Third, we see how online reading comprehension appears to require skills, strategies, and dispositions that are likely to contain new elements not required during offline reading comprehension. Both types of reading may involve questions, location, evaluation, synthesis, and communication, but each type contains a somewhat different skill set because each depends on different technologies. A book requires the ability to use an index and a table of contents to locate information; the Internet requires the new skills that a search engine demands.

We also see how intertwined reading and writing become; online reading often has elements of communication that are simultaneous with comprehension. In online environments, we read while we write and we write while we read.

Finally, we see how one should not assume that offline reading and online reading are the same. If they were isomorphic, high-achieving offline readers would always be high-achieving online readers and vice versa. Indeed, the most striking aspect of these cases is that we find a low-achieving offline reader, one who has been formally identified because of reading difficulty, performing at a high level during online reading. This reader achieved scores in the upper quartile of all online readers, a somewhat surprising outcome. Conversely, we saw how one of the highest achieving offline readers was unable to perform the online reading task at the same level as this learning-disabled reader. Isomorphism does not exist between offline and online reading comprehension.

Issues for Research and Practice

This review of research helps us understand that the Internet has become a central context for reading and that—online—reading changes in important ways. It also tells us that far too little research has focused on the nature of online reading comprehension because we have often assumed it to be identical to offline reading comprehension.

The video examples of online reading provide visible examples of what online reading looks like, a rich and complex mixture that typically begins with a question and includes locating, evaluating, synthesizing, and communicating, often in unique informational genres and with new online tools such as

search engines, blogs, attachments, email, and others. Because online reading comprehension often begins with a question, new literacies are required to accomplish traditional aspects of reading during the comprehension process.

The examples also show us how we should not assume that low-achieving offline readers are necessarily low-achieving online readers or vice versa. To do so is likely to misjudge each student's potential and each student's instructional needs.

The mistaken assumption that online reading comprehension is the same as offline reading comprehension is unfortunate but common throughout the educational system. It is most visible, perhaps, in state reading assessments. Not a single state reading assessment measures students' ability to read search engine results; not a single state reading assessment measures students' ability to evaluate information critically that they read online; and not a single state reading assessment includes the reading of email messages, blogs, or wikis (Leu, Ataya, & Coiro, 2002).

This suggests that current policies, with their focus on testing skills and strategies required for offline reading, but not online reading comprehension, may be exacerbating the problem they seek to solve. Economically challenged school districts currently have little incentive to include online reading comprehension skills in the instructional program because they are under the greatest pressure to raise reading test scores on assessments that have nothing to do with online reading comprehension. As a result, many students go unsupported in developing the new literacies of online reading comprehension in school, especially those students who require support the most—those who have access to the Internet at home the least.

The failure to understand that online reading requires new skills and strategies is not limited to assessments, however. It is a systemic failure. We require teachers who are literate themselves with these new literacies, school leadership teams who understand why it is essential to integrate the Internet into literacy education, state reading and writing standards that include new literacies in their lists of essential skills, and reading and writing curricula that provide instructional support in how best to integrate new literacies into classroom lessons. To continue to ignore this systemic failure is to continue our failure to prepare students for new literacies of the twenty-first century.

What Should We Teach?
Although early work on the nature of the skills required to read and comprehend information online has established a broad outline of what is required, more research is needed to understand completely all of the skills and strategies essential to online reading comprehension. In addition, we need to recall that the rapidly changing nature of the Internet may make a complete taxonomy of these skills a Sisyphean task. Nevertheless, we know that online reading comprehension almost always begins with a question or a problem to solve, is usually limited to informational texts, and requires new skills and strategies to navigate the complex and rich informational space that defines the Internet. Initial research (Coiro, 2007; Coiro & Dobler, 2007; Henry, 2006; Leu, Kinzer, Coiro, & Cammack, 2004), as well as the examples we have presented in this chapter, suggests that new comprehension skills appear in five areas: developing an important question, locating information online, critically evaluating information that readers locate, synthesizing across texts to determine a likely answer, and communicating discoveries to others.

How Should We Teach These New Literacies of Online Reading Comprehension?
The answer to this question is not yet clear because so little research has been conducted to study online reading comprehension in classroom learning contexts. We do know that students at the seventh-grade level acquire online reading comprehension skills as rapidly from exchanging them in small groups as they do through more formal instructional lessons (Castek et al., 2006). This suggests that socially mediated experiences may be especially useful as instructional models are developed for teaching the new literacies of online reading comprehension. Thus, models such as Internet Workshop (Leu, 2002), Internet Project (Harris & Jones, 1999; Leu, 2001), Internet Inquiry (Leu, Leu, & Coiro, 2004), and Internet Reciprocal Teaching (Castek, 2006) may be important starting points. Clearly, however, we require an

aggressive research agenda to explore fully the important efficacy issues in teaching the new literacies of online reading comprehension.

The Consequences of Change

This chapter has attempted to show how change is required in our conception of reading comprehension. New online reading comprehension skills and strategies will be required as, increasingly, our reading worlds move to the Internet. Traditional notions of reading comprehension, traditional methods of assessment, and traditional curricular materials will not be sufficient to prepare students adequately for the new literacies required online.

Perhaps the first and most important step is to recognize that changes in online reading comprehension take place on the Internet. Preliminary work (Coiro, 2007; Coiro & Dobler, 2007; Henry, 2006; Leu, Kinzer, Coiro, & Cammack, 2004) supports this observation; the videos of online reading comprehension presented in this chapter illustrate it. Realizing that we need to reconsider the nature of reading comprehension on the Internet is not a minor accomplishment. From it, many other consequences of change are possible.

This would attract, for example, more researchers to study the issue, providing a more precise roadmap for instruction. It would also make it more likely that we thoughtfully include the new literacies of online reading comprehension within state reading assessments. Additionally, this would make possible greater access to online information. Understanding the nature of the issue would also make it possible to provide current classroom teachers with extensive professional development to enhance their own new literacies skills along with instruction in how best to integrate models such as Internet Workshop, Internet Project, Internet Inquiry, and Internet Reciprocal Teaching into their classroom curriculum. Also, teacher educators could prepare new teachers to understand more fully how best to integrate instruction in online reading comprehension instruction into all subject areas. Most important, however, is the possibility of realizing the goal that every teacher seeks—to ensure that all of our students are fully prepared in reading so that they might each fulfill their personal dreams and make our world a better place through their accomplishments.

Notes

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