Research on Instruction and Assessment in the New Literacies of Online Reading Comprehension

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> *"The knowledge economy is about how the new technologies have transformed the way we think and act...To thrive in the global knowledge economy, it is going to be important to change the whole educational system to ensure a wide base of knowledge workers who understand and use information technologies."*
>
> (Riley, 2003, paragraphs 8-10)

The Internet has rapidly become the defining medium for information, communication, and reading comprehension in the twenty-first century (Friedman, 2005; Partnership for 21st Century Skills, 2004; 2006; The New Literacies Research Team, 2007). Moreover, research indicates that online reading comprehension is not isomorphic with offline reading comprehension; proficient readers offline are not always proficient readers online (Coiro, 2007; Leu, Zawilinski, Castek, Banerjee, Housand, Liu, & O'Neil, in press). Additional reading comprehension skills are required to be a successful online reader (Castek, Leu, Coiro, Gort, Henry, & Lima, in press; Coiro & Dobler, 2007; Henry, 2006; Leu, Castek, Hartman, Coiro, Henry, Kulikowich, & Lyver, 2005). The emergence of new online reading comprehension skills has profound consequences for instruction as reading has moved from page to screen. These new literacies have redefined many aspects of traditional comprehension instruction.

In this chapter, we will explore online reading comprehension, instruction, and assessment. The chapter will:

- provide data to establish that the Internet is now a central context for reading comprehension;
- define the new literacies of online reading comprehension and review research in this area;
- define the emerging outlines of Internet Reciprocal Teaching (IRT), an instructional model used to teach online reading comprehension;
- explore emerging assessment practices in online reading comprehension;
- identify key public policy and research questions to direct upcoming work; and
- describe what classroom instruction in the new literacies of online reading comprehension might be like in the future.

The Internet is This Generation's Defining Technology For Information, Reading Comprehension, and Learning

It is increasingly clear that online reading comprehension has become central to success in the twenty-first century. Consider some of the evidence for this claim:

1. Over one billion readers are reading online today, one-sixth of the world's population (de Argaez, 2006; Internet World Stats: Usage and Population Statistics, n.d.).
2. Internet use at work to read, write, communicate, and solve problems increased by nearly 60% in the U.S. during 2002 among all employed adults 25 years of age and older (U.S. Department of Commerce, 2002).
3. Many of the productivity gains realized during the past decade in the economies of the world are due to the rapid integration of the Internet into the workplace to share information, communicate, and solve problems (van Ark, Inklaar, & McGuckin, 2003; Matteucci, O'Mahony, Robinson, & Zwick, 2005).
4. In the U. S., students aged 8-18 report spending more time reading online per day, 48 minutes, than reading offline, 43 minutes per day (Kaiser Family Foundation, 2005).

5. More than 90% of adolescent students in the U.S. with home access to the Internet, report using the Internet for homework (Pew Internet & American Life Project, 2001). Over 70% of these students used the Internet as the primary source for information on their most recent school report or project while only 24% of these students reported using the library for the same task.
6. The first international assessment of online reading comprehension will take place in 2009. The PISA International Assessment of Reading (Organization for Economic Co-operation and Development [OECD], n.d.) will provide important information about online reading comprehension to public policy makers around the world who are demanding it. Additional assessments of online reading comprehension are also beginning to be reported (see Bennett, Persky, Weiss, & Jenkins, 2007).

These data suggest that the Internet is now the defining technology for reading in a digital, socially-networked, multimodal, hyperlinked, and multi-tasking world of information and communication (see also Bleha, 2005; Borzekowski, Fobil, & Asante, 2006; Livingstone & Bober, 2005; Ludlow, 2006; Pew Internet and American Life Project, 2005.) The rate of growth in online reading has been exponential. In the history of literacy, no other technology for reading, writing, or communicating has been adopted so rapidly, by so many people, in so many places, and with such expansive implications for literacy. These changes have prompted research in online reading comprehension, seeking to understand what it means to read online and how best to support students in doing so.

Research in The New Literacies of Online Reading Comprehension

Research in online reading comprehension is informed by theoretical work in new literacies (Coiro, Knobel, Lankshear & Leu, in press-a; Leu, Kinzer, Coiro, & Cammack, 2004). Broadly conceived, a new literacies perspective argues that the nature of literacy and learning is rapidly changing and transforming as new technologies emerge. While there are many perspectives associated with the term *new literacies* (e.g., Cope & Kalantzis, 2000; Gee, 2003; Kress, 2000; Hull & Schultz, 2002; Lankshear & Knobel, 2003; 2006; New London Group, 1996; Street, 1998), the most recent theoretical review of this work (Coiro, Knobel, Lankshear & Leu, in press-b) concludes that most share a set of common assumptions: (a) new skills, strategies, dispositions, and social practices are required by new technologies for information and communication; (b) new literacies are central to full participation in a global community; (c) new literacies regularly change as their defining technologies change; and (d) new literacies are multifaceted and benefit from multiple points of view. Results from investigations framed in a new literacies perspective have challenged existing classroom practices in literacy education (Beach & O'Brien, in press; Dalton & Proctor, in press; Merchant, in press; Snyder & Bulfin, in press; Unsworth, in press; Wyatt-Smith & Elkins, in press).

Within this broader context of new literacies theory and research, a new literacies perspective of online reading comprehension (Leu et al., 2004) has also emerged to frame online reading comprehension as a problem-based inquiry process involving new skills, strategies, and dispositions on the Internet to generate important questions, and then locate, critically evaluate, synthesize, and communicate possible solutions to those problems online. What differs from earlier models of traditional print comprehension is that online reading comprehension is defined not only around the purpose, task, and context but also by a process of self-directed text construction (Coiro & Dobler, 2007) that occurs as readers navigate their own paths through an infinite informational space to construct their own versions of the online texts they will read. During this process both new and traditional reading comprehension skills are required. The overlap between online and offline reading enriches, but also complicates, our understanding of reading comprehension in the 21st century. Any model of online reading comprehension must begin with that basic observation.

What are the new skills and strategies for successful online reading comprehension? The answer is still emerging, though the outlines are becoming clearer. We know for example, that the new literacies of online reading comprehension occur within a process that includes the skills and strategies required to identify an important question directing the reader to locate, critically evaluate, synthesize, and communicate information with the Internet (Leu, Reinking, Carter, Castek, Coiro, Henry, Malloy, Robbins, Rogers, & Zawilinski, 2007).

Consider, first, the initial phase of online reading comprehension -- we read on the Internet to solve problems and answer questions. How a problem is framed or how a question is understood is a central aspect of online reading comprehension. Recent work by Taboada and Guthrie (2006) within traditional texts suggests that reading initiated by a question differs in important ways from reading that does not. 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 comprehension.

Locating information online is another aspect of online reading comprehension. It also requires new online reading comprehension skills such as using a search engine, reading search engine results, or quickly reading a web page to locate the best link to the information that is required. Many students lack these skills (Coiro, 2007; Leu, et. al, 2007). Of those who do use a search engine, for example, many do not appear to know how to read search engine results, instead clicking down the list of links in a "click and look" strategy (Leu, et. al., 2007).

Locating information during the online reading comprehension process may create a bottleneck for the subsequent skills of online reading comprehension (Henry, 2007). That is, those who possess the online reading comprehension skills necessary to locate information can continue to read and solve their problem; those who do not possess these skills cannot. In fact, this bottleneck may contribute to the lack of isomorphic performance between online and offline readers.

Another area in which online reading comprehension requires a unique set of skills is during critical evaluation. Whereas critical evaluation is important when reading offline information, it is perhaps more important online, where anyone can publish anything; knowing the stance and bias of an author become paramount to comprehension and learning. Determining this in online contexts requires new comprehension skills and strategies. For example, knowing which links take you to information about who created the information at a site (and actually choosing to follow these links) becomes important. So too, is knowing how to check the reliability of information with other information at other sites. Students do not always possess these skills. In one study (Leu, et. al, 2007), 47 out of 53 higher performing online readers in 7th grade believed a site designed to be a hoax was reliable (*Save the Endangered Pacific Northwest Tree Octopus: http://zapatopi.net/treeoctopus/*), despite that most students indicated in an interview that they did not believe everything they read online. Moreover, when told the site was a hoax, a number of students insisted it provided accurate and reliable information.

Adults also appear to lack critical evaluation skills on the Internet, especially when it comes to search engine results. The Pew Internet and American Life Project (Fallows, 2005) found that whereas 92 percent of adults were confident about their searching abilities, 62 percent were unaware of the distinction between commercial and non-commercial results, and 68 percent said that search engines provide a fair and unbiased source of information. Clearly, many segments of our population have yet to acquire a full complement of online reading comprehension skills and dispositions to enable them to be effective at locating information and thinking critically about what they have found.

The Teaching Internet Comprehension Skills to Adolescents (TICA) project (Leu & Reinking, 2005) has been studying these and other skills essential to online reading comprehension. An evolving checklist of online reading comprehension skills, in all of the areas required during online reading comprehension (understanding and developing questions, locating

information, critically evaluating information, synthesizing information, and communicating information) is located in Appendixes A and B. Videos of students demonstrating these skills, during online reading, may be viewed at: http://www.newliteracies.uconn.edu/iesproject/videos/

Applying Reciprocal Teaching Approaches to Teaching The New Literacies Of Online Reading Comprehension

How should we begin to think about teaching online reading comprehension skills and strategies? A logical approach would be to review the research on comprehension to determine which instructional models appeared most effective with teaching offline reading comprehension. The substantial effect sizes reported for one model of comprehension instruction, Reciprocal Teaching (Brown & Palincsar, 1989; Palincsar & Brown, 1984) would be especially noticeable in any review. Reciprocal Teaching has been shown to consistently improve students' comprehension of texts when implemented in ntervention settings (Alfassi, 1998; Brand-Gruwel, Aarnoutse & Van Den Bos, 1997; DeCorte, Vershaffel & Van De Ven, 2001; Fung, Wilkinson & Moore, 2003; Hacker & Tenent, 2001). A meta-analytic review of sixteen studies (Rosenshine & Meister, 1994) showed that reciprocal teaching had a consistent, large, and positive effect on comprehension outcomes. Median effect sizes across the studies were between .34 to .60 on teacher-designed tests.

What defines the instructional approach, Reciprocal Teaching? Key elements of this model include:

- the use of traditional, printed texts, which are often narratives;
- the reading of a common text;
- the teaching of a small group of students, often struggling readers;
- teacher modeling of comprehension strategies;
- a focus on predicting, questioning, clarifying, and summarizing strategies;
- a gradual release of responsibility away from the teacher as students take on the modeling of comprehension strategies;
- collaboration and discussion among all participants in each reciprocal teaching group

While working in small groups, teachers and students take turns leading discussions of the text and demonstrating each strategy. Eventually, through continued practice and a gradual release of responsibility, students begin to develop a useful repertoire of metacognitive strategies for better understanding what they read. Over time, these strategies appear to become self-regulated and transfer to new reading contexts (e.g., Cooper, Boschken, McWilliams, & Pistochini, 2000; Palincsar, 1986; Palincsar & Klenk, 1992).

Modifying Reciprocal Teaching For Online Reading Comprehension Instruction

To better prepare students for the unique challenges of reading on the Internet, we have begun to explore how best to frame instruction in online reading comprehension within middle school language arts classrooms (Leu & Reinking, 2005), middle school science classrooms (Leu et al., 2005) and in self-contained elementary school classrooms (Castek, in process). In each setting, our model of instruction has been informed by the well-established research in Reciprocal Teaching (Brown & Palincsar, 1989; Palincsar & Brown, 1984; Rosenshine & Meister, 1994). It has also been informed by other research that has adapted this model, originally developed to serve small groups of struggling readers, to classroom learning contexts involving a wider spectrum of students (e.g., Hacker & Tenent, 2002).

Over time, our work has led us to modify a number of the elements of Reciprocal Teaching. Some changes have resulted from the differences between offline and online reading contexts. Others have resulted from moving a small-group instructional model, initially developed for teaching low performing readers, to meet the needs of self-contained classroom teachers who confront both larger numbers of students and a wider range of reading proficiency.

Additional changes have resulted from our decision to adapt Reciprocal Teaching within classrooms where students each have their own computer. We have found it important for each student to have a computer with wireless access to the Internet. The facilities in most school computer labs make both interactive group work and discussions about strategy use quite problematic. Each is central to Reciprocal Teaching as well as to our evolving model, which we call Internet Reciprocal Teaching. Other issues we have encountered with computer labs include the encroachment on instructional time necessitated by walking classes to the lab and back to the home classroom as well as the limited times that computer labs are free. In addition, we are mindful that our work seeks to develop a model of instruction for the future, where we expect students to have their own laptops with wireless connections to the Internet, such as those found in Maine and an expanding number of districts around the U.S. (Dunleavy, Dexter, & Heinecke, 2007; Zucker, 2004). As a result of all of these considerations we have chosen to develop our model of Internet Reciprocal Teaching around the use of wireless laptop carts in the classroom. In the following sections, we compare and contrast Reciprocal Teaching and Internet Reciprocal teaching.

The use of traditional printed texts, often narratives vs. online informational texts. Reciprocal Teaching uses traditional, printed texts, often narratives, whereas Internet Reciprocal Teaching takes place with online resources, typically informational texts. Thus, somewhat different opportunities and challenges appear during lessons using Internet Reciprocal Teaching. Given the focus on expository texts, for example, it is somewhat easier to integrate Internet Reciprocal Teaching lessons into other content areas. Reading selections with this model, on the other hand, often have more specialized vocabulary and are sometimes more challenging. However, multimedia sources on the Internet often are available to support reading comprehension in ways not possible with traditional texts. These additional media sources, though, also require new reading skills and strategies to effectively exploit their potential.

The reading of a common text vs. the reading of unique texts. Small-group Reciprocal Teaching instruction typically requires a common text that all students read linearly (Palincsar & Brown, 1984). With Internet Reciprocal Teaching, because of the nature of online reading, readers typically construct individual, texts through hyperlinks and the textual paths that readers choose to follow. As a result, during Internet Reciprocal Teaching, strategy instruction focuses on both the common and the unique processes by which students navigate through multiple and different texts, rather than the reading of one, common text. Teachers and students model their choices about which links are most relevant to a group or individual question through think-alouds. They discuss how to most efficiently locate information within different kinds of websites, and how to synthesize ideas across multiple texts and media and how to best represent the answers to their questions. Instruction emphasizes choices about which sites to read, where to read on those sites, which links to follow to gather additional information, and when to conduct new searches.

Teaching a small group of students, often struggling readers vs. teaching in larger, heterogeneously grouped classrooms. Reciprocal Teaching was initially developed for working with a single small group of struggling readers (Palincsar & Brown, 1984). We work in diverse, urban and rural classrooms, heterogeneously grouped, with approximately 20-25 students in each class. Students come to our classrooms with a wide range of ability levels and backgrounds. They include English Language Learners as well as students who qualify for special services and students who struggle with reading, although they do not qualify for such services. Because we work in self-contained classrooms, we have been required to adapt the basic context of Reciprocal Teaching – a single teacher working with a small group of struggling readers – to fit classrooms with one teacher for many more, and many different, students. The diversity of our classrooms provides a wider range of students with which to exchange a potentially wider range

of online reading strategies. It also requires somewhat different organization and management in a classroom.

Greater teacher modeling of offline comprehension strategies vs. greater student modeling of online comprehension strategies. A key component of Reciprocal Teaching is that teachers model reading comprehension strategies, often by explaining their thinking during reading. Internet Reciprocal Teaching provides some degree of teacher modeling but we also seek to take advantage of the novel online reading comprehension strategies that students bring to classrooms. There are two benefits. First, students frequently possess novel and potentially powerful online reading comprehension strategies, sometimes ones with which teachers may be unfamiliar. Second, we have found that empowering students in this fashion, helping them to see themselves as experts with important skills to share, is a powerful instructional advantage. Often this approach includes students who might normally be thought to be weaker readers (Coiro, 2007; Leu et al., in press; New Literacies Research Team, 2005). We have found that honoring their contributions to the learning process encourages greater investment in classroom activities and increases their engagement with texts and the learning process generally. Further, we have observed several occasions when previously passive students, who were also weaker offline readers, took a leadership role in strategy discussions.

A focus on predicting, questioning, clarifying, and summarizing strategies vs. a focus on questioning, locating, critically evaluating, synthesizing, and communicating strategies. Reciprocal teaching emphasizes four basic strategies: predicting, questioning, clarifying, and summarizing. The most important meta-analysis of reciprocal teaching studies (Rosenshine & Meister, 1994) indicated that statistically significant gains in reading comprehension appeared regardless of whether two, three, four, or ten strategies were included, suggesting that it may not be the type nor the number of strategies that are taught, so much as it is the cognitive processing that is made explicit during reading. We have followed this course in our development of Internet Reciprocal Teaching. Whereas Internet Reciprocal Teaching often includes the strategies used during Reciprocal Teaching, it focuses more on the somewhat novel online reading comprehension strategies required to develop or understand a question and then use that question to locate, critically evaluate, synthesize, and communicate information on the Internet.

A gradual release of responsibility away from the teacher as students take on the modeling of comprehension strategies. Both Reciprocal Teaching and Internet Reciprocal Teaching gradually transfer to students the responsibility for modeling comprehension strategies. We have found it effective to provide the gradual release of responsibility by using an instructional scheme with three phases: Phase 1 includes direct, whole class instruction of basic skills and strategies of Internet use; Phase 2 includes group work and the reciprocal exchange of online reading comprehension strategies by students with their peers; Phase 3 includes online individual inquiry units, sometimes with collaborative efforts involving other students in other classes, perhaps even in other parts of the world, and periodic strategy sharing sessions with groups. We discuss these phases in more detail in a subsequent section. In the process, students assimilate strategies by engaging in explicit discussions about the online contexts in which these strategies appear to be most useful. Engaging in explicit discussions of strategy usage enhances students' awareness of their own thinking processes (Palincsar & Brown, 1984) and facilitates the application of these strategies in new reading contexts.

Collaboration and discussion among all participants in each reciprocal teaching group. Both Reciprocal Teaching and Internet Reciprocal Teaching take advantage of the potential that results from group conversations about reading strategies and about the new strategies that appear to be especially helpful in various contexts. This posture is especially useful for online reading comprehension, because new technologies continually appear online (new and revised search engine tools, for example), requiring continually new online reading comprehension strategies to take advantage of their potential.

An Evolving Model of Internet Reciprocal Teaching

As we have come to understand the differences and the similarities between the contexts of Reciprocal Teaching and Internet Reciprocal Teaching, we have continued to investigate aspects of Internet Reciprocal Teaching during a year-long formative experiment (see Reinking & Bradley, 2004; 2008) conducted in five 7th-grade English Language Arts classrooms with a high proportion of low-achieving students. Instruction followed our three-phase model, seeking to develop online reading comprehension skills and strategies required to: (a) generate online research questions; (b) locate information; (c) critically evaluate information; (d) synthesize information; and (e) communicate information among students.

Initially, the online reading comprehension skills that we sought to develop were informed by the patterns of strategy use demonstrated by approximately 50 proficient online readers, gathered during think-aloud sessions the previous year (see Carter & Henry, 2006; Coiro, Malloy, & Rogers, 2006; Leu & Castek, 2006; Leu, et al., 2007). Throughout the year, we refined how online reading experiences were structured for students based on insights gained from an iterative cycle of data collection including interviews and discussions among researchers, teachers, and sometimes students. We adjusted both *what* was taught and *how* it was taught based on what appeared to enhance or inhibit the effectiveness of particular interventions in different classroom contexts (Castek & Reinking, 2006). Across the classrooms, we aimed to increase academic engagement, encourage active reading, and promote students as experts in online reading comprehension. These goals were based intentionally on those of Reciprocal Teaching (Palincsar & Brown, 1984). To achieve these goals, we encouraged student demonstrations of online reading comprehension to the maximum extent possible and supported strategy application across a wide range of online informational tasks.

Although we are still in the midst of analyzing the data collected in our formative experiment, we highlight here two important patterns that have begun to emerge from our work with students in urban and rural low-achieving school districts.

Internet Reciprocal Teaching Progresses Through Three Phases of Online Reading Instruction

One important pattern that emerged from our formative experiments was that different students required different levels of support at different points during the year in which we implemented IRT (Leu, et. al., 2007). Thus, we found it helpful to organize our thinking about online reading comprehension instruction into three phases that sought to accomplish the gradual release of responsibility, which is a central aspect of Reciprocal Teaching (Palincsar, 1986; Palincsar & Brown, 1984).

Phase 1: Teacher led instruction. During Phase 1, students take part in teacher-led demonstrations designed to establish essential classroom routines and foundational Internet and computer skills. During this phase, the teacher explicitly models online reading comprehension strategies and introduces procedures for conducting group discussions. Teaching procedures are designed to nurture collaborative group work skills among students. Internet Reciprocal Teaching lessons in this phase highlight foundational skills and strategies (e.g., handling laptops, opening and quitting applications, managing multiple windows) that serve as precursors to online reading comprehension. Instruction occurs most often as a whole class to facilitate participation in think-aloud demonstrations. Toward the end of this phase, mini-lessons provide students practice in applying what they had learned with a partner or two. Whereas the time spent in this phase may differ widely across classrooms, our work suggests that a gradual transition out of the teacher-led phase can be made when the majority of students are able to demonstrate application of the skills and strategies listed on the observational checklist for Phase I (see Appendix A).

Phase 2: Collaborative modeling of online reading comprehension strategies. In Phase 2 of Internet Reciprocal Teaching, teachers and students begin to share the responsibility for introducing new strategies and demonstrating how and when those strategies might be most useful. Lessons in this phase present small groups of students with common problems, often

linked to key curriculum standards or goals, and designed to elicit important online reading comprehension skills. One day, for example, the groups in a class may be given these three problems and asked to solve them with the Internet: (a) How high is Mt. Fuji in Japan; (b) Find another different answer to this same question; (c) Which answer do you think is most accurate and how did you determine that it was? Students in each group are guided to discuss their solutions, exchanging reading comprehension strategies for locating information and critically evaluating information. Lessons are designed to minimize teacher talk and to maximize the time students are engaged with the task. An essential part of planning is setting aside time at the end of each lesson for students to debrief and to exchange strategies with the entire class after having already done so in their small groups.

Initially, lessons focus on locating and critical evaluating online information, and later, shift to synthesis and communication with a variety of online communication tools (e.g., email, blogs, wikis, Google docs, Instant Messages). Importantly, as this phase of instruction progresses, activities are carefully sequenced from more structured to less-structured experiences to take maximum advantage of students' growing online reading knowledge and proficiency.

Because collaborative group exchanges of online reading comprehension strategies play an increasingly important role in this phase of instruction, students may sometimes be grouped homogeneously to collaboratively contend with an information challenge that targets a particular area of weakness. At other times, students may be heterogeneously grouped to share individual strengths while collaboratively solving online information problems. Consistent with the principles of Reciprocal Teaching, an important component of this second phase is working in groups to teach peers and their teacher(s) new strategies for navigating and comprehending information on the Internet. In this way, both teachers and students work together to document student progress on the observational checklist of Phase 2 strategies necessary for transitioning to Phase 3 (See Appendix B). These activities reinforce students' growing independence as proficient online learners and prepare students for peer-teaching one another more regularly during Phase 3.

Phase 3: Inquiry. Finally, in Phase 3, instruction begins to move toward independent online inquiry related to the curriculum. Online work often takes place individually and in small groups, while the teacher acts more as a facilitator of online strategy use. Students are given opportunities to develop their own questions to research or problems to solve using strategies introduced in Phase 2. Students are also encouraged to select what they believe to be the most effective means for communicating their findings, again applying strategies introduced earlier in instruction. Initially, in this phase, information is gathered and shared with reciprocal strategy support from students *within* the class. Later, the instructional focus shifts to support students as they solve problems with students in other classrooms in their school or district, around the country, or even in other parts of the world via telecollaborative inquiry projects (Leu, Leu, & Coiro, 2004). Ultimately, students are invited to develop their own lines of inquiry related to their curriculum to spontaneously demonstrate strategies during authentic online reading experiences and to collaboratively work with others as they use the Internet to solve the important problems they have defined. It is at this point that students develop an understanding of how important it is to play an active role in their own learning about the curriculum and experience firsthand the satisfaction associated with knowing how to question, locate, evaluate, synthesize, and communicate information with the Internet.

Internet Reciprocal Teaching Progresses From Simpler to More Complex Online Reading Comprehension Tasks

A second conclusion we are drawing from our formative observations of online reading comprehension instruction across five classrooms is that effective Internet Reciprocal Teaching lessons move progressively from simpler tasks that are somewhat similar to reading offline texts to those that are more complex and quite different than reading offline texts. For example, we

found it helpful to begin with demonstrations and strategy discussions that fostered skimming and scanning skills to locate specific information on a single webpage. Discussions centered around text features that lead readers to specific information on the page; students collaboratively shared strategies that helped clarify how good online readers strategically skim and scan a webpage and then check their facts by locating similar facts on other reliable web pages. Discussions quickly led to considering how to investigate an author's credibility and reliability, which provided a purpose for strategically skimming and scanning additional pages on a website where the information was found.

In turn, these discussions prompted students to search for information on other websites that could be used to confirm or to refute ideas by consulting additional sources. Discussions about the different types of search engines and how each worked prompted important new strategies for online reading comprehension. Amidst these discussions, Internet Reciprocal Teaching lessons introduced tasks that offered students time to explore strategies for using keywords to narrow questions, using synonyms to revise searches on the same topic, and combining key words to effectively refine searches and locate specific information. Teachers and students modeled procedures for strategically reading search results and determining, for example, where to read for information on a search results page, how to determine when it was important to initiate a new search, or how to search more efficiently by attending to clues about the potential reliability of a website by examining the website's address as it appears in the results list. These types of lessons helped students learn how to make informed choices about where to read and how to navigate to reliable sites that contain information suited to their purposes for reading.

As students became more efficient in locating the information they were seeking, they had more time to read across multiple websites, summarize important information, and explore their options for communicating their findings to others. Reciprocal teaching lessons then began to highlight strategies for organizing information into charts or idea webs, turning their collection of facts and multimedia resources into a cohesive summary, collaboratively editing their work, composing messages for particular audiences, and selecting appropriate communication tools. Small-group discussions focused on the skills and strategies required to use, among other technologies, Instant Messages, email, blogs, and wikis. With support from the teacher and their classmates, students began to realize that each of these types of communication require unique inferential reasoning skills to use them effectively. Students were given time to practice how to construct clear messages appropriate for various contexts and purposes.

Over time, guided demonstrations of authentic research tasks aligned to the curriculum provided students with opportunities to apply different combinations of the online reading comprehension skills and strategies they had learned, and taught others, in their reciprocal teaching discussions. Students were able to choose a related topic of interest, query search engines, locate relevant and reliable information, synthesize information from multiple sources, and communicate it to others using procedures appropriate to the type of communication tool they selected.

Measuring the Potential Benefits of Internet Reciprocal Teaching

In addition to exploring new ways of thinking about new literacies instruction, we have begun to develop a number of different methodologies and instruments to measure proficiency in online reading comprehension. Although space does not allow for a detailed description of each assessment, we share below our think-aloud methodology and four broad categories of formal and informal instruments we have designed to evaluate the effects of Internet Reciprocal Teaching and specifically to determine whether instruction can improve offline and online reading comprehension and content area learning over time. Interested readers can see examples of these measures at the following the web site: http://www.newliteracies.uconn.edu/IRT

Student Think-Aloud Methodology

Process-based think-aloud methodologies (see Afflerbach, 2002; Pressley & Afflerbach, 1995) have provided an important window into the nature of online reading comprehension ability and how students respond to various online reading activities. Rich and complex think-aloud data have provided us information to systematically refine our evolving understanding of the online reading comprehension skills demonstrated by proficient and less skilled adolescent online readers. In a series of studies (see Leu, et. al., 2007; Leu & Castek, 2006; New Literacies Research Team, 2005), participants were asked to read online and to think aloud, using both researcher-selected and student-selected reading assignments. Students' online reading sessions were recorded using Camtasia software (http://www.techsmith.com/camtasia.asp), which creates a real-time movie of all online actions on the screen as well as an online recording of verbal think-aloud data.

Data from the Camtasia recordings were then transcribed, coded, and analyzed to reveal: (a) the processes students use (or don't use) and (b) the understandings (or misconceptions) students may have about how best to compose task-related online questions, and use a range of online contexts (e.g., search engines, informational websites, interactive images, email, instant message, and/or blogs) to locate, critically evaluate, synthesize, and communicate their answers to others. From our analyses, patterns of effective strategy use were systematically added to our evolving taxonomy of proficient online reading strategies. Likewise, patterns of ineffective online reading processes across several populations of adolescent readers helped inform our decisions about which skills, strategies, and dispositions we might focus on for our sequence of Internet Reciprocal Teaching lessons.

Formative Assessments of Online Reading Comprehension Strategy Use

One fairly open-ended and easy-to-administer instrument is called the Formative Assessment of Students' Emerging Knowledge of Internet Strategies (FASEKIT). Once every three to four weeks, students are given approximately fifteen minutes to list the most important strategies they employ when using the Internet. For each strategy, they are also asked to explain why that strategy is important and when they might use it as part of their online reading experience. This open-ended measure invites students to describe their online strategy use in their own words. A review of student responses can help to quickly determine the declarative, procedural, and conditional knowledge (Paris, Wasik & Turner, 1991) students may be acquiring from Internet Reciprocal Teaching lessons (and their interactions with peers) and highlight areas of misunderstanding that may be addressed in upcoming lessons.

Curriculum-Based Information Challenges

A second category of useful measures designed to assess online reading comprehension ability are challenges to find information that require a range of Internet technologies and that link directly to a particular curricular theme or learning objective. As members of the TICA Project (Leu et al., 2007) conducted a formative experiment of how IRT might help accomplish its pedagogical goals we investigated, for example, the use of: (a) leveled Jeopardy-style blog challenges to evaluate seventh graders online reading proficiency while studying biographies; (b) a mystery email challenge that integrated samples of descriptive writing and personal letters to evaluate the development of new literacy strategies as part of a unit on narrative writing; (c) a Wikipedia activity that challenged students to share information they researched about respiratory scientists with a worldwide audience; (d) an informational website challenge designed to prompt prediction and inferential reasoning skills as part of an interdisciplinary unit on the Holocaust; and (e) an interactive blog discussion that assessed seventh-grade students' ability to share critical evaluation strategies they used to determine which informational websites were reliable and which were unreliable. In each case, observational data and feedback from students and teachers suggested that informal measures of online reading comprehension can be effectively integrated into authentic classroom literacy activities and aligned to grade level objectives in reading, language arts, and content-area curricula. Sample tasks and student

responses can be found for each of these online informational challenges at the following website: http://www.newliteracies.uconn.edu/IRT.

Performance-Based Assessments of Online Reading Comprehension Ability

A third type of instrument that has demonstrated the ability to validly and reliably estimate online reading performance among adolescent readers is called the Online Reading Comprehension Assessment (ORCA). In our work, we have developed several ORCA instruments (see Coiro, 2006) that invite students to solve a series of online information requests about middle-school topics such as homelessness, the solar system, human body systems, and the Iditarod sled dog races. These rubric-guided measures have asked students to search for, locate, critically evaluate, synthesize, and communicate solutions to online information requests using instant messaging [*ORCA Instant Message* (The New Literacies Research Team, 2005)], email and blog technologies [*ORCA-Blog Human Body Systems* (The New Literacies Research Team, 2005)], and an online quiz interface [*ORCA-Scenarios I and II* (Coiro, 2007) and *ORCA-Iditarod* (Leu & Reinking, 2005)].

Data from these studies provided evidence suggesting that the ORCA instruments have demonstrated the ability to measure online reading proficiency and evaluate the potential of classroom instruction for increasing online reading comprehension over time. In one study (New Literacies Research Team, 2005), scores on the ORCA-Instant Message and ORCA-Blog measures suggested that high Internet integration coupled with 12 weeks of strategy instruction yielded statistically higher scores in online reading comprehension and science concept learning among seventh-grade students in one science classroom when compared to a control group in a second science classroom. In addition, a low correlation between scores on the ORCA-Blog and standardized reading scores provided preliminary that online reading is not isomorphic with offline reading.

In a second study from Year 2 of our TICA project (Leu & Reinking, 2005), results of paired t-test analyses indicated a statistically significant increase in mean scores on the ORCA-Iditarod from the beginning to the end of the year across at-risk students in five middle school reading and/or language arts classrooms. Data from a third study that used the ORCA-Scenarios I and II (Coiro, 2007) revealed additional evidence that online reading comprehension ability is not isomorphic with offline reading comprehension ability. Taken together, data from these three studies informed the development of a rubric-guided ORCA instrument called the ORCA-Iditarod Revised. This assessment is being used in a randomized experimental study in Year 3 of the TICA Project to evaluate the extent to which Internet Reciprocal Teaching instruction can improve students' comprehension and learning offline and online in four diverse classroom settings. These measures may be viewed at the following website: http://www.newliteracies.uconn.edu/IRT

Objective Measures of Online Reading Comprehension Ability

A fourth category of measures involves the use of multiple-choice and short-answer items to estimate a student's level of online reading comprehension ability. Although we believe there are several limitations to estimating online reading proficiency with a set of isolated multiple-choice items, it would be useful to have valid instruments that require less time to administer and less time to score than performance based ORCA assessments. Initial efforts to measure online reading comprehension from a new literacies perspective with isolated skill items (Carter & Henry, 2006), as opposed to a series of scenario-based tasks, has demonstrated the potential for future work in this area. Henry (2007) revised this instrument to develop the Digital Divide Measurement Scale for Students (DDMS-S), which included 14 forced-response items that measured reading to locate and reading to critically evaluate online information. The items proved to be both statistically valid and reliable among scores of 1,768 middle school students, and thus provided an objective alternative to a rubric scoring system for estimating skills in online location and critical evaluation.

Given the promising results of Henry's work, we have recently begun to develop a series of parallel, multiple-choice items to be used in a repeated-measures design to capture and track growth in online reading comprehension ability at five particular points over the course of a twenty-week intervention. By collecting data with parallel objective items across five points in time in conjunction with the pre-post estimates of online reading comprehension proficiency measured with the process-based ORCA-Iditarod Revised, we will then have the ability to more closely examine the relation of scores across the two types of instruments; compare possible gains and losses associated with each assessment; and consider the relative utility of each as a valid way of evaluating the potential of Internet Reciprocal Teaching to improve online reading achievement among adolescents at-risk of dropping out of school.

Public Policy Failures And Future Research

Most would agree that achieving high levels of online reading comprehension is an essential requirement for full participation in the age of the Internet. Unfortunately, however, in the United States especially, little is being done to accomplish that goal in schools (Partnership for 21st Century Skills, 2004). Students seldom receive instruction in online reading comprehension (Henry, 2007) and no state in the U.S. systematically includes online reading comprehension skills in their state standards or in state reading comprehension assessments (Leu, Ataya, & Coiro, 2002). Indeed, the National Assessment of Educational Progress, "The Nation's Report Card" for the United States (Lee, Grigg, & Donahue, 2007) fails to include any online reading comprehension skills such as the reading of search engine results. Of even greater concern, however, the recently constructed *NAEP Reading Framework for 2009* (National Assessment Governing Board, 2004) includes no online reading comprehension skills. Because of this omission, online reading comprehension ability will not be evaluated in any of "The Nation's Report Card" reports until at least 2019 when a new framework will be developed (Leu, 2007).

Public Policy

The current No Child Left Behind (NCLB) legislation (U.S. Department of Education [DOE], 2002), with its focus on testing skills and strategies required for offline reading, but not online reading comprehension, may be exacerbating the very problem it seeks to solve. Economically challenged school districts currently have little incentive to include online reading comprehension skills in their instructional programs, 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 literacies of online reading comprehension in school. This unfortunate omission is especially true for those students who require our support the most -- those who have access to the Internet at home the least (Leu, 2007).

This situation raises one of the most central questions for public policy in the United States: *Why are the new literacies of online reading comprehension not included in any national or state assessments of reading comprehension?* This unfortunate situation severely compromises the potential and the future of students in the United States. To continue ignoring online reading comprehension in reading assessments and during classroom reading instruction is to reify a static and increasingly less-relevant understanding of reading comprehension in a world that has gone online, global, and networked. More importantly, this practice appears to harm the very students who are in need of our greatest assistance with reading comprehension.

Future Research

A more systematic integration of online reading comprehension into classroom instruction and assessment should be a high priority for future research. However, to be useful, that research must be conducted at multiple levels of our educational system, because the changes that are called for are profound and effect multiple levels of education including assessment, instruction, curriculum, teacher education, professional development, and school leadership to name just a few. A number of important research questions need to be addressed in

order to build on the emerging research base that is developing around the changing nature of reading comprehension:

1. *What are the most reliable and valid ways of assessing online reading comprehension to provide classroom teachers and school leadership teams with the most useful information to inform instruction?* The upcoming PISA International Assessment of Reading (OECD, n.d.) and the assessment approaches described in this chapter are just the beginning of the efforts needed to determine optimal methods for assessing online reading comprehension. Much more work must be conducted in this area to more fully understand optimal assessment strategies for the variety of needs that we have.
2. *How should Internet Reciprocal Teaching or other instructional practices be modified to support students, at all grade levels, to develop greater online reading comprehension ability?* Much more work needs to follow initial attempts to understand effective classroom instruction including the use of a broader range of research methodologies such as formative and design experiments. Further, important work has yet to be conducted with younger students to determine the contexts in which the learning of online reading comprehension strategies is optimized.
3. *What curriculum resources best support the needs of teachers and students in developing online reading comprehension skills and strategies?* To support classroom instruction, we require extensive curricular resources that promote the development of the new literacies of online reading comprehension. We require important research efforts designed to evaluate optimal curricular materials designed to increase online reading comprehension.
4. *How might teacher education best support the development of new teachers who can effectively integrate the skills and strategies of online reading comprehension into classroom instruction?* A central aspect of change will require the effective preparation of new teachers in this area. An innovative study such as the one being carried out in the University of Connecticut's secondary teacher education program seeks to prepare a new generation of middle and high school teachers who are fluent with the new literacies of online reading comprehension and integrate them into their subject area curriculum (Hartman, Leu, Olson, & Truxaw, 2005).
5. *How might professional development be organized to most effectively prepare teachers for the changes to reading comprehension that has happened during their lifetimes?* An entire generation of teachers will require extensive professional development to effectively manage the transition from offline reading comprehension to online reading comprehension. Many teachers will need to acquire these new literacies themselves. How might we best accomplish this important aspect of change?
6. *How might school leadership teams be prepared to provide the vision and leadership to direct the changing nature of reading comprehension instruction in their schools and districts?* Change happens in schools only with school leaders who have the vision for that change. This will require retraining a generation of school leaders who understand the changes that have taken place to reading in an online world.
7. *What might be the impact of after-school 'new-literacies' clubs be on the in-school reading comprehension proficiencies of struggling on- and offline readers?* Because many of the tools and much of the access to online content is available in out-of-school contexts, how could it impact the in-school

comprehension skills of struggling readers? (Hartman & Leu, in review; Leu & Hartman, in review).

As these questions suggest, a new and ambitious agenda of reading comprehension research is needed. That agenda will require all of us to devote our attention to the changing nature of reading comprehension, reading comprehension instruction, and reading comprehension assessment.

What Might Classrooms Look Like In The Future?

In a world of rapidly changing technologies, it is impossible to predict what might take place even a few years into the future. Prediction in this area is a dangerous game since the landscape is one that rapidly and repeatedly changes. Who, for example, might have predicted the appearance of MySpace, Facebook, Second Life, Wikipedia, YouTube, or any other recent technologies just five years ago? Nevertheless, some possible outlines can be anticipated, assuming that public policies change to include the new literacies of online reading comprehension within increasingly important national and state assessments. It is likely that one-to-one computing and wireless access to the Internet will become a reality in every school. It is also likely that students and teachers will engage in important online reading projects to advance content area learning while they also develop greater proficiency with online reading comprehension. In addition, it is quite likely that students will collaborate with other students around the world in common learning projects (Leu, et al., 2004) as we begin to discover the potential of the Internet for increasing our understanding of the world around us, increasing life's opportunities for every child. Based on the promise of research emerging on the new literacies of reading comprehension, our hope is that we will be insightful enough and our public policies foresighted enough to bring this world to reality sooner, rather than later.

References

Afflerbach, P. (2002). The use of think-aloud protocols and verbal reports as research methodology. In M. Kamil (Ed.), Methods of literacy research (pp. 87-103). Hillsdale, NJ: Erlbaum Associates.

Alfassi, M. (1998). Reading for meaning: The efficacy of reciprocal teaching in fostering reading comprehension in high school students in remedial reading classes. *American Educational Research Journal, 35*, 309-332.

Beach, R. & O'Brien, D. (in press). *Teaching Popular Culture Texts In The Classroom.* In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of Research on New Literacies.* Mahwah, NJ: Erlbaum.

Bennett, R. E., Persky, H, Weiss, A. R., & Jenkins, F. (2007). Problem solving in technology-rich environments: A report from the naep technology-based assessment project. Retrieved October 5, 2007 from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2007466

Bleha, T. (May, June, 2005). Down to the wire. *Foreign Affairs*. Retrieved December 15, 2005, from http://www.foreignaffairs.org/20050501faessay84311/thomas-bleha/down-to-the-wire.html

Borzekowski, D., Fobil, J., & Asante, K. (2006). Online access by adolescents in Accra: Ghanaian teens' use of the Internet for health information. *Developmental Psychology, 42,* 450 – 458. Retrieved December 1, 2006, from http://www.apa.org/journals/releases/dev423450.pdf

Brand-Gruwel, S., Aarnoutse, C., Van Den Bos, K.P. (1997). Improving text comprehension strategies in reading and listening settings. *Learning and Instruction, 8,* 63-81.

Brown, A. L., & Palincsar, A. S. (1989). Guided cooperative learning and individual knowledge acquisition. In L. B. Resnick (Ed.), *Cognition and instruction: Issues and agendas* (pp. 393–451). Hillsdale, NJ: Erlbaum.

Carter, A. & Henry, L. A. (2006). *A survey of Internet usage and online reading: In-school and out-of-school settings.* In D. Reinking & D. J. Leu (Chairs), Studying the new literacies of online reading comprehension among adolescents at risk to become dropouts. Paper presented at the annual meeting of the National Reading Conference, Los Angeles, CA.

Castek, J. (in process). *An examination of classroom instruction that integrates the new literacies of online reading comprehension: Exploring the contexts that facilitate acquisition and the learning outcomes that result.* Dissertation being completed at The University of Connecticut.

Castek, J., Leu, D. J., Jr., Coiro, J., Gort, M., Henry, L. A., & Lima, C. (in press). *Developing new literacies among multilingual learners in the elementary grades*. In L. Parker (Ed.) Technology-Based Learning Environments for Young English Learners: In and out of school connections. Lawrence Erlbaum Associates: Mahwah, NJ.

Castek, J. & Reinking, D. (2006, December). Working with teachers in a formative experiment. In D. J. Leu, Jr. (Chair). *Studying the new literacies of online reading comprehension among adolescents at risk to become dropouts.* An alternative symposium session presented at the National Reading Conference, Los Angeles, CA. Online: http://www.newliteracies.uconn.edu/iesproject/events.html

Coiro, J. (2006). *Measuring Internet comprehension: Accessing, evaluating, and communicating information*. In D. Reinking & D. Leu, (Chairs), Developing Internet reading comprehension strategies among adolescents at risk to become dropouts. Poster presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Coiro, J. (2007). *Exploring changes to reading comprehension on the Internet: Paradoxes and possibilities for diverse adolescent readers.* Unpublished doctoral dissertation. University of Connecticut, Storrs. Available online at http://www.newliteracies.uconn.edu/ coirodissertation/

Coiro, J., & Dobler, E. (2007). Exploring the comprehension strategies used by sixth-grade skilled readers as they search for and locate information on the Internet. *Reading Research Quarterly*, *42,* 214-257.

Coiro, J., Knobel, M., Lankshear, C., & Leu, D. J. (Eds.). (in press-a). *Handbook of research in new literacies.* Mahwah, NJ: Erlbaum.

Coiro, J., Knobel, M., Lankshear, C., & Leu, D. J. (in press-b). Central issues in new literacies and new literacies research. In J. Coiro, M. Knobel, C. Lankshear, and D. J. Leu. *The handbook of research in new literacies.* Mahwah, NJ: Erlbaum.

Coiro, J., Malloy, J. & Rogers, A. (2006). *Patterns of effective strategy use among adolescent readers.* In D. Reinking & D. J. Leu (Chairs), Studying the new literacies of online reading comprehension among adolescents at risk to become dropouts. Paper presented at the annual meeting of the National Reading Conference, Los Angeles, CA.

Cooper, J. D., Boschken, I., McWilliams, J. & Pistochini, L. (2000). A study of the effectiveness of an intervention program designed to accelerate reading for struggling readers in the upper grades. In T. Shanahan & F. V. Rodriguez-Brown (Eds.), 49th yearbook of the National Reading Conference (pp. 477-486). Chicago: National Reading Conference.

Cope, B., & Kalantzis, M. (2000). *Multiliteracies*. London, UK: Routledge.

Dalton, B. & Proctor, C. P. (in press). *Understanding understanding in a new literacies space: Changing the relationship of text, reader and activity in service of improving diverse learners' comprehension*. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of research in new literacies.* Mahwah, NJ: Erlbaum.

de Argaez, E. (January, 2006). *Internet world stats news*, *14*. Retrieved February 1, 2006 from http://www.internetworldstats.com/pr/edi014.htm#3

DeCorte, E., Verscgaffel, L., Van De Ven, A. (2001). Improving text comprehension strategies in upper primary school children: A design experiment. *British Journal of Educational Psychology, 71*, 531-559.

Dunleavy, M., Dexter, S., Heinecke, W. F. (2007) What added value does a 1:1 student to laptop ratio bring to technology-supported teaching and learning? *Journal of Computer Assisted Learning 23*, 440–452.

Fallows, D. (2005). *Search engine users.* Pew/Internet & American Life Project. Retrieved July 1, 2006 from http://www.pewinternet.org/PPF/r/146/report_display.asp

Friedman, T. L. (2005). *The world is flat: A brief history of the twenty-first century.* New York: Farrar, Straus & Giroux.

Fung, I.,Y., Wilkinson, I., Moore, D., W. (2003). L1-assisted reciprocal teaching to improve ESL students' comprehension of English expository text. *Learning and Instruction, 13*, 1-31.

Gee, J. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave.

Hacker, D. J., Tenent, A. (2002). Implementing reciprocal teaching in the classroom: Overcoming obstacles and making modifications. *Journal of Educational Psychology,* 94, 699-718.

Hartman, D. K., Leu, D. J., Olson, M. R., & Truxaw, M. P. (2005). Reading and writing to learn with the 'new literacies': Preparing a new generation of teachers and researchers to develop literate American adolescents. New York: Adolescent Literacy Preservice Initiative, Carnegie Corporation of New York.

Henry, L. A. (2006). SEARCHing for an answer: The critical role of new literacies while reading on the Internet. *The Reading Teacher, 59*, 614-627.

Henry, L. A. (2007). *Exploring new literacies pedagogy and online reading comprehension among middle school students and teachers: Issues of social equity or social exclusion?* Unpublished doctoral dissertation. University of Connecticut, Storrs.

Hull, G. and Schultz, K. (Eds.). (2002). *School's out! Bridging out-of-school literacies with classroom practice*. New York: Teachers College Press.

Internet world stats: Usage and population statistics. (n.d.) Retrieved October 25, 2005 from http://www.internetworldstats.com/stats.htm.

Kaiser Family Foundation. (2005). *Generation M: Media in the lives of 8-18 year-olds.* Retrieved on September 15, 2007from http://www.kff.org/entmedia/7251.cfm

Kress, G. (2000). *Multiliteracies: literacy learning and the design of social futures*. South Yarra: MacMillan Publishers Australia Pty Ltd.

Lankshear, C. & Knobel, M. (2003). *New literacies*. Maidenhead: Open University Press.

Lankshear, C. & Knobel, M. (2006). *New literacies, Second Edition.* Maidenhead: Open University Press.

Lee, J., Gregg, W., and Donahue, P. (2007). *The nation's report card: Reading 2007* (NCES 2007–496). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, Washington, D.C.

Leu, D. J. (May 12, 2007). *What happened when we weren't looking? How reading comprehension has changed and what we need to do about it.* Invited keynote address to the Research Conference of the International Reading Association. Toronto, Canada.

Leu, D. J. (2006). New literacies, reading research, and the challenges of change: A Deictic Perspective. In J. Hoffman, D. Schallert, C. M. Fairbanks, J. Worthy, & B. Maloch (Eds.) *The 55th Yearbook of the National Reading Conference.* (1-20). Milwaukee, WI: National Reading Conference.

Leu, D. J., Ataya, R., & Coiro, J. (December, 2002). *Assessing assessment strategies among the 50 states: Evaluating the literacies of our past or our future?* Paper presented at the

National Reading Conference. Miami, FL.

Leu, D. J., & Castek, J. (2006). *What online reading comprehension skills and strategies are characteristic of more accomplished adolescent users of the Internet.* In D. Reinking & D. Leu, (Chairs), Developing Internet reading comprehension strategies among adolescents at risk to become dropouts. Poster presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Leu, D. J., Castek, J., Hartman, D., Coiro, J., Henry, L., Kulikowich, J., & Lyver, S. (2005). *Evaluating the development of scientific knowledge and new forms of reading comprehension during online learning.* Final report presented to the North Central Regional Educational Laboratory/Learning Point Associates. Retrieved May 15, 2006 from http://www.newliteracies.uconn.edu/ncrel.html

Leu, D. J., & Hartman, D. K. (2007). *What skills are required for successful online reading comprehension? What do students who are high-performing, online readers tell us?* Paper presented at the annual meeting of the New England Reading Association, Augusta, ME.

Leu, D. J., Jr., Kinzer, C. K., Coiro, J., & Cammack, D. (2004). Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In R.B. Ruddell & N. Unrau (Eds.), *Theoretical models and processes of reading*, *Fifth Edition* (1568-1611). International Reading Association: Newark, DE.

Leu, D. J., Jr., Leu, D. D. & Coiro, J. (2004). *Teaching with the Internet: New literacies for new times (4th ed.)*. Norwood, MA: Christopher-Gordon.

Leu, D. J. & Reinking, D. (2005). *Developing Internet Comprehension Strategies Among Adolescent Students At Risk to Become Dropouts*. U. S. Department of Education, Institute of Education Sciences Research Grant. Retrieved June 20, 2006 at http://www.newliteracies.uconn.edu/ies.html.

Leu, D.J., Reinking, D., Carter, A., Castek, J., Coiro, J., Henry, L. A., Malloy, J., Robbins, K., Rogers, A., Zawilinski, L. (April 9, 2007). *Defining online reading comprehension: Using think aloud verbal protocols to refine a preliminary model of Internet reading comprehension processes.* Paper presented at The American Educational Research Association. Chicago, IL Available: http://docs.google.com/Doc?id=dcbjhrtq_10djqrhz

Leu, D. J., Zawlinski, L., Castek, J., Banerjee, M., Housand, B., Liu, Y., & O'Neil, M. (in press). What is new about the new literacies of online reading comprehension? In A. Berger, L. Rush, & J. Eakle (Eds.) *Secondary school reading and writing: What research reveals for classroom practices*. NCTE/NCRLL: Chicago, IL.

Livingstone, S., & Bober, M. (2005). *UK children go online*: *Final report of key project findings.* Project Report. London: London School of Economics and Political Science.

Ludlow, A. (March 2, 2006). Rolling out the national e-Mexico system. Paper presented at the Digital Cities Convention. Houston, TX. Retrieved March 15, 2006 from http://www.w2idigitalcitiesconvention.com/02282006/e_s/emexico.html

Matteucci, N., O'Mahony, M., Robinson, C. & Zwick, T. (2005). Productivity, workplace performance and ICT: industry and firm-level evidence for Europe and the US. *Scottish Journal of Political Economy. 52, 359-386.*

Merchant, G. (in press). Digital writing in the early years. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of Research in New Literacies.* Mahwah, NJ: Erlbaum.

National Assessment Governing Board (2004). *NAEP Reading Framework.* Retreived July 15, 2007 from http://www.naepreading.org/

The New Literacies Research Team. (2005). *New literacies for learning.* In D. J. Leu, (chair), New literacies for learning. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

New Literacies Research Team (2005). New Literacies Research Team*. (December, 2005). *A methodology for studying the new literacies of online reading comprehension.* National Reading Conference. Miami, FL. *Including: Castek, J., Coiro, J., Fogarty, E., Hartman, Henry, L.A. & Leu, D.J., Jr.

The New Literacies Research Team. (2007). New literacies, new challenges, and new opportunities. In M. B. Sampson, S. Szabo, F. Falk-Ross, M. M. Foote & P. E. Linder (Eds.) *Multiple literacies in the 21st century: The twenty-eighth yearbook of the College Reading Association* (31-50). Logan, UT: College Reading Association.

The New London Group (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review, 66*(1), 60-92.

New London Group. (2000). A pedagogy of multiliteracies designing social futures. In B. Cope & M. Kalantzis (Eds.), *Multiliteracies: Literacy learning and the design of social futures* (pp. 9–37). London: Routledge.

Organization for Economic Co-operation and Development [OECD]. (n.d.) *The OECD programme for international student assessment.* Retrieved August 15, 2007 from http://www.oecd.org/dataoecd/51/27/37474503.pdf

Palincsar, A.S. & Brown, A.L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 1, 117-175.

Palincsar, A.S. (1986). Reciprocal teaching. In *Teaching reading as thinking*. Oak Brook, IL: North Central Regional Educational Laboratory.

Paris, S. G., Wasik, B. A., & Turner, J. C. (1991). The development of strategic readers. In R. Barr, M. L. Kamil, P. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research* (pp. 609-640). White Plains, NY: Longman.

Partnership for 21st Century Skills. (2004). *Learning for the 21st century.* Retrieved August 15, 2006 from http://www.21stcenturyskills.org/reports/learning.asp

Palincsar, A. S. (1986). Metacognitive strategy instruction. *Exceptional Children, 53,* 118-124.

Palincsar, A. S. & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*, 117-175.

Palincsar, A. S. & Klenk, L. (1992). Fostering literacy learning in supportive contexts. *Journal of Learning Disabilities, 25,* 211-225, 229.

Paris, S. G., Wasik, B. A., & Turner, J. C. (1991). The development of strategic readers. In R. Barr, M.L. Kamil, P. Mosenthal, & P.D. Pearson (Eds.), *Handbook of reading research* (Vol. 2, pp. 609–640). White Plains, NY: Longman.

Partnership for 21st Century Skills. (2006). *Are they really ready for work? Employer's perspectives on the basic knowledge and applied skills of new entrants to the 21st Century U.S. Workforce.* Report written in collaboration with The Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management. Retrieved December 9, 2006 from http://www.21stcenturyskills.org/documents/FINAL_REPORT_PDF9-29-06.pdf

Pew Internet & American Life Project (2005). *Teens and Technology.* Retrieved April 15, 2006 from http://www.pewinternet.org/topics.asp?c=4

Pew Internet & American Life Project (2001). *The Internet and education: Findings of the Pew Internet & American Life Project.* Retrieved October 15, 2002 from http://www.pewInternet.org/reports

Pressley, M., & Afflerbach, P. (1995). *Verbal protocols for reading: The nature of constructively responsive reading.* Hillsdale, NJ: Erlbaum.

Reinking, D., & Bradley, B. A. (2004). Connecting research and practice using formative and design experiments. In N. Duke & M. Mallette (Eds.), *Literacy research methodologies* (pp. 149-169). New York: Guilford Press.

Reinking, D., & Bradley, B. A. (2008). *On formative and design experiments*. New York: Teachers College Press.

Riley, T. (2003). An overview of the knowledge economy. eGov Monitor Weekly, eGov Monitor Weekly, August 4. Retrieved September 15, 2005 from http://www.egovmonitor.com/features/riley07.html

Rosenshine, B., & Meister, C. (1994). Reciprocal teaching: A review of the research. *Review of Educational Research, 64,* 479–530.

Snyder, I. & Bulfin, S. (in press). *Using new media in the secondary English classroom.* In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of research in new literacies.* Mahwah, NJ: Erlbaum.

Street, B. (1998). New literacies in theory and practice: What are the implications for language in education? *Linguistics and Education, 10*(1), 1-24.

Taboada, A., & Guthrie, J. T. (2006). Contributions of student questioning and prior knowledge to construction of knowledge from reading information text. *Journal of Literacy Research, 38,* 1–35.

Unsworth, L. (in press). *Multiliteracies and metalanguage: Describing image/text relations as a resource for negotiating multimodal texts.* In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of research in new literacies.* Mahwah, NJ: Erlbaum.

U.S. Department of Commerce: National Telecommunications and Information Administration (2002). *A nation online: How Americans are expanding their use of the Internet*. Washington, DC: Author.

U.S. Department of Education (DOE). (2002). *No Child Left Behind Act of 2001*. Washington DC: Author. Retrieved September 22, 2005, from the U. S. Department of Education Web site: http://www.ed.gov/policy/elsec/leg/esea02/index.html

Wyatt-Smith, C. & Elkins, J. (in press). *Multimodal reading and comprehension in online environments.* In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of research in new literacies.* Mahwah, NJ: Erlbaum.

Van Ark, B., Inklaar, R., & McGuckin, R.H. (2003). ICT productivity in Europe and the United States Where do the differences come from? *CESifo Economic Studies. 49*, 295-318.

Zucker, A. (2004). Developing a research agenda for ubiquitous computing in schools. *Journal of Educational Computing Research, 30,* 371-386.

APPENDIX A

TICA Basic Skills (Phase One) Checklist[1]

Most of the students and all of the groups in my class know how to:

	Computer Basics	Comment
❑	Turn a computer on/off	
❑	Use the mouse/track pad	
❑	Follow classroom and school rules for computer use	
❑	Open programs and files using icons and/or the Start Menu (PC)	
❑	Log on and log off from individual file space	
❑	Create/open a new folder/file	
❑	Launch a word processor	
❑	Open a word processing file	
❑	Type a short entry in a word processing file	
❑	Copy text	
❑	Cut text	
❑	Paste text	
❑	Delete text	
❑	Name a word processing file and save it	
❑	Open a new window	
❑	Open a new tab	
	Web Searching Basics	
❑	Locate and open a search engine	
❑	Type key words in the correct location of a search engine	
❑	Type addresses in the address window	
❑	Use the refresh button	
❑	Use the "BACK" and "FORWARD" buttons	
❑	Use a search engine for simple key word searches	
	General Navigation Basics	
❑	Maximize/minimize windows	
❑	Open and quit applications	
❑	Toggle between windows	
	E-mail Basics	
❑	Locate and open an e-mail program	
❑	Attach documents to e-mail messages	
❑	Compose, edit and send email messages	
❑	Receive and reply to messages	

[1] These skills and strategies inform and guide instruction during Phase 1 but they are not intended to limit instruction. New skill and strategy needs will emerge within each classroom. Each teacher must respond to (and document) those additional skill and strategy needs during the year. When most students and all groups can accomplish this list, the move to Phase Two will take place

TICA Phase II Checklist[1]

Most of the students and all of the groups in my class know how to:

	Understand and Develop Questions	Lesson Evidence and Comments
	Teacher-Generated Questions	
❑	Use strategies to ensure initial understanding of the question such as: • rereading the question to make sure they understand it. • paraphrasing the question. • taking notes on the question. • thinking about the needs of the person who asked the question.	
❑	Use strategies to monitor an understanding of the question such as: • knowing when to review the question. • checking an answer in relation to the question to ensure it is complete.	
	Student-Generated Questions	
❑	Determine what a useful initial question is, based on a variety of factors that include interest, audience, purpose, and the nature of the inquiry activity.	
❑	Determine a clear topic and focus for questions to guide the search for information.	
❑	Modify questions, when appropriate, using strategies such as the following: • narrowing the focus of the question. • expanding the focus of the question. • developing a new or revised question that is more appropriate after gathering information.	
	Locate Information	**Lesson Evidence and Comments**
	Locating Information By Using A Search Engine And Its Results Page	
❑	Locate at least one search engine.	
❑	Use key words in a search window on a browser that has this or on a separate search engine.	
❑	Use several of the following general search engine strategies during key word entry: • topic and focus • single and multiple key word entries • phrases for key word entry	
❑	Use several of the following more specialized search engine strategies during key word entry: • quotation marks • paraphrases and synonyms • Boolean • advanced search tool use	
❑	Copy and paste keywords and phases into the search engine window while searching for information.	
❑	Read search engine results effectively to determine the most useful resource for a task using strategies such as: • knowing which portions of a search results page are sponsored, containing commercially placed links, and which are not. • skimming the main results before reading more narrowly • reading summaries carefully and inferring meaning in the search engine results page to determine the best possible site to visit • understanding the meaning of bold face terms in the results • understanding the meaning of URLs in search results (.com, .org, .edu, .net) • knowing when the first item is not the best item for a question • monitoring the extent to which a search results page matches the information needs. • knowing how to use the history pull down menu.	
❑	Monitor the multiple aspects of search engine use and make appropriate revisions and changes throughout the process	
❑	Select from a variety of search engine strategies to locate useful resources when an initial search is unsuccessful:	

	• Knows the use and meaning of the "Did you mean...?" feature in google. • Adjusts search engine key words according to the results of a search. • narrows the search. • expands the search. • reads search results to discover the correct vocabulary and then use this more appropriate vocabulary in a new search. • Shifts to another search engine.	
❑	Bookmark a site and access it later.	
❑	Use specialized search engines for images, videos, and other media sources.	
	Locating Information Within A Website	
❑	Quickly determine if a site is potentially useful and worth more careful reading	
❑	Read more carefully at a site to determine if the required information is located there.	
❑	Predict information behind a link accurately to make efficient choices about where information is located.	
❑	Use structural knowledge of a web page to help locate information, including the use of directories.	
❑	Recognize when you have left a site and know how to return back to the original site.	
❑	Know how to open a second browser window to locate information, without losing the initial web page.	
❑	Know how to use an internal search engine to locate information at a site.	
❑	Monitor the reading of a web page and knows when it contains useful information and when it does not.	
	Critically Evaluate Information	**Lesson Evidence and Comments**
	Bias and Stance	
❑	Identify, evaluate, and recognize that all websites have an agenda, perspective, or bias.	
❑	Identify and evaluate bias, given a website with a clear bias.	
❑	Identify and evaluate the author of a website whenever visiting an important new site.	
❑	Use information about the author of a site to evaluate how information will be biased at that site.	
	Reliability	
❑	Investigate multiple sources to compare and contrast the reliability of information.	
❑	Identify several markers that may affect reliability such as: • Is this a commercial site? • Is the author an authoritative source (e.g., professor, scientist, librarian, etc.)? • Does the website have links that are broken? • Does the information make sense? • Does the author include links to other reliable websites? • Does the website contain numerous typos? • Does the URL provide any clues to reliability? • Do the images or videos appear to be altered?	
❑	Understand that Wikipedia is a reasonable, but imperfect, portal of information.	
❑	Identify the general purpose of a website (entertainment, educational, commercial, persuasive, exchange of information, social, etc.).	
❑	Identify the form of a website (e.g. blog, forum, advertisement, informational website, commercial website, government website, etc.) and use this information when considering reliability.	

	Accuracy	
❑	Evaluate information based on the degree to which it is likely to be accurate by verifying and consulting alternative and/or especially reliable sources.	
	Synthesize Information	**Lesson Evidence and Comments**
❑	Understand both the specific information related to the task as well as the broader context within which that information is located	
❑	Synthesize information from multiple media sources including written prose, audio, visual, video, and/or tables and graphs.	
❑	Separate relevant information from irrelevant information.	
❑	Organize Information effectively.	
❑	Manage multiple sources both on and offline including: • Choose tools to meet the needs of managing information (file folders, electronic file folders, notebooks, email, etc.) • Cite sources • Take notes with paper & pencil, when appropriate. • Take notes with a word processor, when appropriate. • Type notes using short cut strokes such as highlight/cut/copy/paste	
	Communicate Information	**Lesson Evidence and Comments**
❑	Understand that messages have consequences and will influence how others react.	
❑	Use a variety of offline writing/editing tools such as a word processor spell checker, dictionary, thesaurus, pdf, etc.	
❑	Copy/paste text or URL to use in the message.	
❑	Know how to use email including attaching and downloading attachments, logging in, sending messages, opening messages.	
❑	Know how to use IM	
❑	Know how to use blogs including reading and posting information.	
❑	Monitor communication of information for audience or voice (i.e. formal versus informal writing styles)	
❑	Uses a wide array of Internet-based forms of communication, such as: • email and attachments • blogs • wikis • Google Docs • instant messaging • websites • presentation software	
❑	Is aware of the audience and the relationship between audience, purpose, medium, message.	
❑	Knows how to include multiple-media sources within messages.	
❑	Uses formatting such as headings and subheadings to communicate the organization of information within informational text.	

Author Notes

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