Processes: Two Adolescents Reading Independently and Collaboratively on the Internet

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New technologies are constantly changing the landscapes of reading and writing (Coiro, Knobel, Lankshear, & Leu, 2008; Dalton & Proctor, 2008). In addition, transactions and social interactions that facilitate readers' comprehension of print (e.g., Almasi, McKeown, & Beck, 1996; Rosenblatt, 1998) have begun to take on new meaning in complex, online environments (Selfe & Hawisher, 2004; Wyatt-Smith & Elkins, 2008). To learn how individuals are meeting the demands of a 21st century knowledge society, research in a variety of disciplines has shifted attention away from information recall and transmission and toward the construction of personal understanding and co-construction of new knowledge (Assessment and Teaching of 21st Century Skills, 2008; Bransford, Brown, & Cocking, 2000; Wells, 2007). This study seeks to uncover the nature of constructive meaning-making processes as revealed by two skilled adolescent readers engaged in both independent and collaborative online reading situations.

THEORETICAL FRAMEWORKS

We approached this work through three theoretical lenses that conceptualize reading in terms of overlapping dimensions of individual cognition and social interaction. First, our conceptions of reading comprehension are grounded in constructivist theories that posit accomplished readers are actively constructive as they interact with and respond to information in text while reading for a particular purpose (see Kintsch, 1988; Pressley & Afflerbach, 1995; Rosenblatt, 1998). Accordingly, expert readers use a range of strategic cognitive processes to select, organize, connect, and evaluate what they read. More recently, Alexander and Fox (2004) reported that the emergence of a greater range of text types introduces additional dimensions to this set of cognitive reading strategies that continue to reshape perceptions of readers and the reading process. To adequately describe these new forms of reading, Afflerbach and Cho (2008) highlighted the need for additional research that explicitly connects patterns of online reading strategy use to existing models of reading and thinking. Thus, the present study seeks to build on Pressley and Afflerbach's (1995) compendium of constructively responsive reading comprehension strategies with an expanded framework that incorporates processes drawn from contemporary think-aloud studies of online reading comprehension (e.g., Coiro & Dobler, 2007; Schmar-Dobler, 2003; Zhang & Duke, 2008).

Secondly, this study was informed by a new literacies perspective of online reading comprehension that frames reading comprehension as a web-based inquiry process involving skills and strategies for locating, evaluating, synthesizing, and communicating information on the Internet (Leu, Kinzer, Coiro, & Cammack, 2004; Leu, O'Byrne, Zawilinski, McVerry, & Everett-Cacopardo, 2009). Previously developed models of the cognitive reading strategies needed to comprehend printed texts do not sufficiently characterize the complex and unique processes required to locate, evaluate, and comprehend information found on the Internet (see Coiro [in press]; Hartman, Morsink, & Zheng, 2010).

Third, we drew from sociocultural perspectives that view text comprehension as a consequence of working as part of a social group (Schwandt, 1994; Mercer, 1995). Accordingly, we approached this study with the assumption that social interaction contributes to individual development (Vygotsky, 1978) and, further, that technology, as a cultural artifact, can play a key role in mediating social activity (Crafton & Burke, 1994; Wells, 2007). Consequently, this study seeks to examine how two students employed online reading comprehension processes first, independently, and later as partners, as they read and responded to two inquiry prompts.

LITERATURE REVIEW

Reading Comprehension and Verbal Protocol Analysis

In the 1980s and 1990s, much attention was paid to analyzing think-aloud protocols as readers interacted with offline (or printed) texts (see Ericsson & Simon, 1993). As a result, contemporary research and instruction in reading comprehension is grounded in a robust understanding of how skilled readers integrate cognitive reading processes, self-regulated monitoring strategies, and personal knowledge as they construct meaning from offline texts (see Pressley & Afflerbach, 1995; Kucan & Beck, 1997). However, this work was based on studies conducted before widespread Internet use and is not informed by research that characterizes the nature of online reading comprehension. In fact, Afflerbach and Cho (2008) surmised that there likely exist specific strategies critical for successful online reading that have yet to be widely investigated or documented. Thus, it becomes important to update models of reading comprehension to encompass results from think-aloud protocols as readers interact with complex online texts for a range of purposes.

Individual Reading Patterns in Online Environments

Findings from a handful of think-aloud studies of online reading comprehension have emerged to inform work in this area. For example, Schmar-Dobler (2003) and Coiro and Dobler (2007) employed concurrent think-aloud protocols and retrospective interviews with adolescent readers and revealed similar and more complex strategies involving navigation, prior knowledge sources, inferential reasoning strategies, and self-regulated reading processes.

More recently, in an effort to update Pressley and Afflerbach's (1995) model of constructively responsive reading strategies used by accomplished readers when reading offline text, Afflerbach and Cho (2008) synthesized results of 46 think-aloud protocol studies focused on reading strategy use during intertextual, hypertext, and Internet reading. Their analyses revealed many overlaps with offline reading comprehension, but the authors also proposed an entirely new category of online reading processes, *realizing and constructing potential texts to read.* This category represents

"accomplished readers' strategic approaches to reducing uncertainty, determining the most appropriate reading path, and managing a shifting problem space" (p. 212).

Results of two recent think-aloud studies with skilled adults (Zhang & Duke 2008) and adolescent readers (Cho, 2010) specified a set of unique reading strategies that might very well fit in this new category. These reading strategies included generating digital queries; applying prior knowledge of search engines and websites; monitoring one's reading pathways and speed in relation to his/her online reading purposes; determining a suitable reading order; and constructing individualized paths to accessing useful resources. The present study seeks to characterize additional processes of reading comprehension that adolescent readers use as they read online and formulate a response to two researcher-posed information problems.

Collaborative Reading Patterns in Online Environments

In addition to understanding how individuals construct their personal understanding of complex texts, national standards indicate that informal academic discussions, such as those that take place when students collaborate to answer questions, build understanding, and solve problems, are an important focus of the next generation of language arts, literacy, and content area standards (Common Core State Standards Initiative, 2010). Since small groups of students are often assigned to work together to complete school-based inquiry tasks (Smith, Sheppard, Johnson, & Johnson, 2005), it makes sense to learn more about how collaborative online reading situations may influence strategy use, comprehension, and knowledge construction.

Researchers have used think-aloud protocols during paired or small-group reading to explore relationships between social interaction and offline reading (Anderson & Roit, 1993), online reading (Castek, 2008; Dillenbourg & Schneider, 1995) or online discussions (Kim, Anderson, Nguyen-Jahiel, & Archodidou, 2007). However, to our knowledge, no studies have applied Pressley and Afflerbach's (1995) model of constructively responsive reading for individual readers to consider the extent to which these same comprehension processes play out when two adolescents work as partners to solve an inquiry problem online. Consequently, to add to our understanding of constructively responsive reading strategies observed while reading offline texts, the present study sought to explore how two adolescent readers constructed and co-constructed meaning and formulated responses to inquiry tasks, as they first worked online independently, and then with a partner.

METHODS

Participants

Participants for this case study (Yin, 2009) were purposely selected (Merriam, 2009) from a seventh-grade science classroom of 35 students located in a suburban public school in the midwestern United States. Demographics for this middle school population were 80% Caucasian, 12.5% Asian, 4% African American, 2.5% Hispanic, and 2% multi-racial. Initially, twelve students volunteered to participate in the study. From this sample, the teacher was asked to recommend those students with strong academic histories and strong verbal skills in order to achieve rich verbal

as strong academic achievers who also possessed strong verbal skills; these students were likely to provide insights into the types of constructively responsive strategies about which we were interested in learning. This preliminary study reports our analysis of data from two of these six students, Abby and Starfish (pseudonyms).

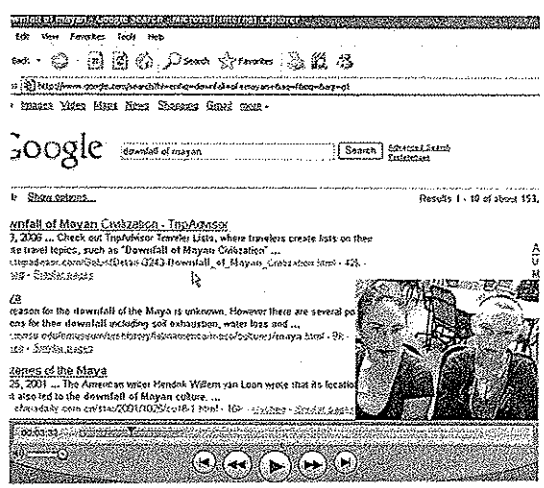
At the time of the study, Abby typically received As or Bs in all academic areas and her standardized reading and writing scores on the 6th grade state achievement test placed her at the state's Advanced level (or Level 1) in offline reading ability. Abby's science teacher described her as highly verbal, well organized, and a good listener. Starfish was also considered a high achiever in all curriculum areas and, like Abby, was classified as Level 1 on the 6th grade state standardized test for reading and writing. Starfish's teacher considered her to be quiet and studious, yet verbally expressive when engaged in academic tasks.

Data Collection

Each student met with a researcher outside of class in the school library to participate in two video-recorded online reading sessions, one individual and one collaborative, in which data were collected using a think-aloud protocol (Pressley & Afflerbach, 1995). Camtasia screen capture software (www.camtasia.com) was used to simultaneously record all on-screen reading actions, verbal think-alouds, and verbal/non-verbal interactions with the text and each other (e.g., nodding, smiling, expressing confusion with facial gestures). For both sessions, a frontal view of each reader was also captured with a camera mounted on the computer (see Figure 1).

In the first online reading session, Abby and Starfish each worked individually (and at separate times) to answer the following prompt: *Should land be set aside to preserve the leatherback sea turtle?* Prior to the session, the researcher read a brief set of directions about how to think aloud while completing the task. Then, students were instructed to think aloud while they independently researched information online that would allow them to make an informed response to the prompt. Immediately after the reading session, each student participated in a short reflective interview about what they learned.

Figure 1. Screenshot of Abby and Starfish's Camtasia Screen Capture Recording that Documented Their Onscreen Reading Actions, Verbal Think-Alouds, and Non-Verbal Interactions with the Text



On a subsequent day, Abby and Starfish were paired together to complete a collaborative online task in which they were asked to research a topic, and come to consensus about, a second prompt: *What caused the downfall of the ancient Mayan civilization?* Again, the researcher

aloud and responding to the prompt. Students were reminded to think aloud as they collaboratively worked to comprehend the range of information they encountered online and construct a response. After completing the collaborative prompt, Abby and Starfish jointly participated in a short reflective interview about what they learned. No time limit was given in either online reading session, but Abby and Starfish's individual reading sessions lasted 33 minutes and 32.5 minutes, respectively, while their collaborative reading session lasted 27.5 minutes.

For all of the data collection, one researcher was always present. Most of the time, the students were able to think aloud as they completed the tasks with little prompting from the researcher. However, occasionally, when more clarification was needed, or when a student seemed confused, the researcher intervened with an open-ended question such as "Tell me what you are thinking now" or "What do you think that means?" Responses to researcher-prompted questions of this sort were coded separately, and were not included in counts of spontaneous (e.g., unprompted) reading comprehension strategies we observed the two readers using.

Data Analysis

Analysis took place in several phases. Initially, we independently reviewed the Camtasia screen-capture recordings of Starfish and Abby's individual reading sessions to get a general sense of how each reader completed the online reading prompt about leatherback sea turtles. Next, transcripts were created that documented all verbal responses and online reading actions (e.g., scrolling, typing search terms, clicking on hyperlinks) made by the students during each session. Because each reader was free to explore any location on the Internet, the website address and actual web text was inserted into the transcript. This provided a way to connect verbal responses, and any relevant non-verbal actions, to particular sections of online text students read. Finally, all verbal responses and associated reading actions were parsed into individual semantic units (Aviv, 2001), which were defined as any discrete and meaningful response to the text.

Once the transcripts were complete, data were analyzed using an abductive reasoning approach (Morgan, 2007). Analysis of the individual reading sessions began with a theory-driven, deductive coding structure derived from a combination of constructively responsive reading strategies observed in verbal protocols of printed text comprehension (Pressley & Afflerbach, 1995) and additional reading strategies observed in protocols of online text comprehension (see Afflerbach & Cho, 2008, 2009; Coiro & Dobler, 2007; Schmar-Dobler 2003; Zhang & Duke, 2008). Then as new patterns emerged, data-driven inductive procedures (Bogdan & Biklen, 2003) were used to revise the coding scheme in order to more accurately represent the set of online reading processes we observed in the present study.

Initially, all three researchers analyzed transcriptions for Abby's individual session to assess the validity of the coding scheme. Researchers met to further refine categories and code definitions, and adjust the coding scheme terminology. Then, each researcher independently coded the transcript from Starfish's individual session. The researchers agreed on 91% of the 172 codes for Abby at the category level (and 82% at the sub-process level) and on 94% of the 175 codes for Starfish at the category level (and 89% at the sub-process level), which demonstrated adequate reliability (Krippendorff, 2003). The resulting coding system of constructively responsive online reading comprehension strategies (see Appendix A) consisted of 56 sub-processes (observed in

of reading comprehension processes and three broad clusters (before-, during-, and after-reading processes). These sub-processes included strategies similar to those observed in studies of offline text comprehension (as denoted by superscript 1 in Appendix A) and additional strategies observed in online reading contexts (as denoted by superscript 2). Two additional sub-processes, observed when students responded to researcher questions or comments, were categorized as "Confirming or Clarifying." The inclusion of this extra coding category reflects Mercer's (1995) notion that dialogues between the researcher and participant can strongly influence a participant's performance in tasks, and thus, should be treated as "part of the object of study" (p. 3) (see also Elbers, 1991).

Next, the complex coding scheme of constructively responsive online reading strategies was applied to the transcriptions from the collaborative reading task, with researchers coding each partner's individual meaning units using the same process used to code students' individual reading sessions. In this phase, researchers agreed on 92% of the 162 codes at the category level and 83% at the sub-process level. In the last phase of analysis, we examined the quantity of each student's contributions and the nature of what they contributed in both the individual and collaborative reading sessions. We sought to explore whether student interactions within a collaborative dyad would mirror the patterns identified during individual online reading or if different patterns would emerge.

FINDINGS

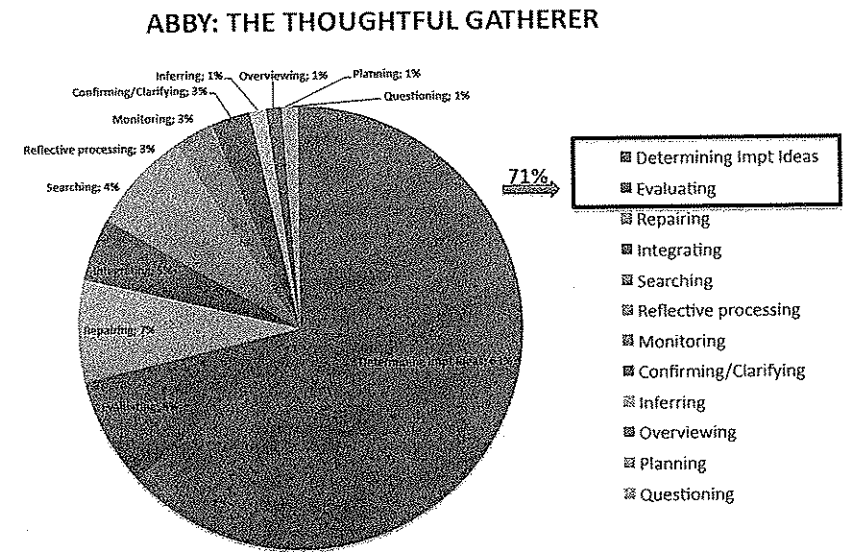
Constructively Responsive Reading Processes Observed in the Individual Reading Task

Abby. According to the coding categories in Appendix A, Abby's protocol revealed that her predominant interactions with the text (71%) involved determining important ideas (63%) and evaluating online text (8%). Abby used her ability to read aloud, read silently, and paraphrase key ideas in 110 of her total 172 interactions. In addition, Abby made 14 evaluative statements, or reactions, to the text as she read. The protocol excerpt that follows reveals Abby's ability to determine what is important about sea turtles and personally respond to these ideas with evaluative comments such as "this is interesting" and "just strange":

> [*Reading silently where text says: "HABITAT: The leatherback is the most pelagic of the sea turtles. Adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the crawl to dry sand is not too far. The preferred beaches have proximity to deep water and generally rough seas."*] This is interesting ... the habitat are sandy nesting beaches with vegetation, and their preferred beaches are to have deep waters and generally rough seas. [*Looks toward researcher*] That's just strange ... because they just lay their eggs on the beaches and then just have time to go to the water.

As depicted in Figure 2, Abby's online reading patterns showed evidence of thoughtful integration processes. She expressed important ideas in familiar terms in order to draw a conclusion about what she read. For example, while silently reading a lengthy section under the heading "Conservation Accomplishments" which detailed a range of publications (e.g., booklets, videos, posters, and newsletters) produced by Greenpeace, the National Audubon society, and others, Abby interpreted the text and concluded:

Figure 2. Abby's Frequency of Constructively Responsive Online Reading Strategy Use During the Individual Reading Session



eventually thinking aloud as she reads/skims] They have printed more materials about the sea turtle so we can learn more about them and what works and everything. [*Reads silently for 15 seconds*] Now the turtles have a great deal of attention, so...they are helping them out—now the general public is aware and they are helping them.

Based on Abby's responsive patterns of gathering, processing, and evaluating online text, we described her as "The Thoughtful Gatherer." Notably, while Abby spent 76% of her individual reading time determining, evaluating, and integrating important ideas (typically conceived as offline reading processes), an additional 15% of her online processing involved searching, monitoring her reading pathways, and repairing those pathways when needed. An excerpt that illustrates these processes is included below, wherein Abby generated an initial search, carefully scrutinized a set of Google search results, determined whether certain parts of a text were relevant to her purpose, and then used this information to repair the direction of her hyperlink selections before she finally settled on a webpage relevant to the task:

Abby: I'm going to type in Leatherback Sea Turtles [*Generates her search terms, clicks the search button, and scrutinizes the returned list of search results. After scanning a descriptive annotation that led to a "Sea Turtle Factsheet"*]...No, cuz that's [*the information*] on all of them *[the other websites*]. [*Shifting her attention to a different search result, following the link, scanning the website for a second, and then quickly clicking the back button*]

Researcher: Okay, so you decided not to go there either.

Abby: No...because it had a bunch of other turtles too [*suggesting that the website*

search results list and selects the third link] Let's see here...ok [*begins skimming new website under section about Sea Turtle Habitats*].

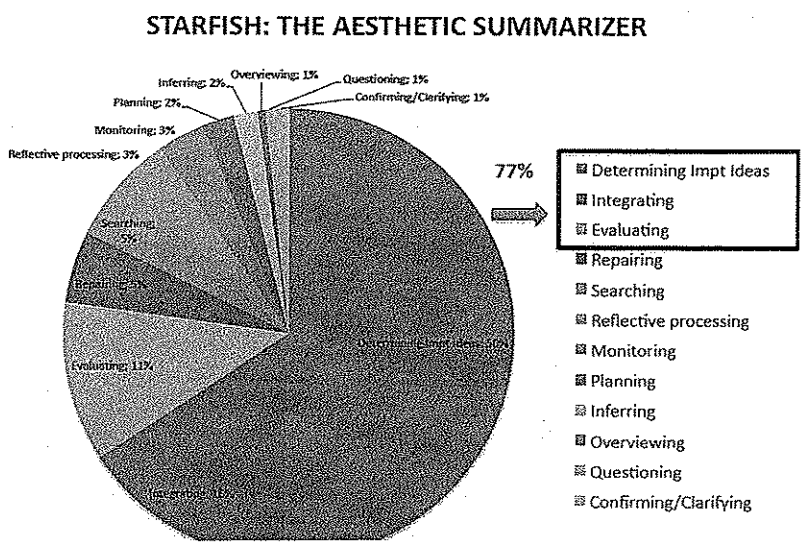
Starfish. If Abby was "The Thoughtful Gatherer" when she independently read on the Internet, then Starfish might best be described as "The Aesthetic Summarizer." Of Starfish's 175 total responses, 77% of the codes related to determining important ideas (50%), integrating (16%), and evaluating (11%) online text (see Figure 3). However, Starfish often responded to information in an aesthetic manner, expressing concern and empathy as she read. Instances when Starfish reacted emotionally as she read and integrated important details about the nesting practices and lifespan of leatherback sea turtles are denoted in bold and underlined:

Starfish: [*reading aloud*]: Only about one in a thousand leatherback hatchlings survive to adulthood. **That's kind of sad.** [*paraphrasing*] Eggs—they die because of humans. [*comments outside of reading—appears to be considering the prompt*]: So we should leave them alone so that they don't die because they are getting extinct because we are killing them. We should leave them on land so we can get more sea turtles. [*paraphrasing*]: Eggs are taken by humans by their nest...[*paraphrasing*]: Many leatherbacks are victims of fishing lines and nets, or they are hit by boats. **That's pretty sad too.** [*paraphrasing*]: Eleven pounds of plastic in their stomach from falling in the water. **That's a lot! That's kind of really sad that we're doing that to them.** There is all this plastic.

Researcher: Do you think that's a problem for them?

Starfish: Yeah. Well, the more plastic they get, the closer they are to dying, and that's when they're getting a lower population and now they are endangered... **That's not good.**

Figure 3. Starfish's Frequency of Constructively Responsive Online Reading Strategy Use During the Individual Reading Session



Another responsive reading pattern that characterized Starfish's use of integration strategies was observed when she stopped reading, summarized key points from what she read across multiple sections of text, and then constructed an interpretation from that summary. Evidence of this strategic integration is apparent in the protocol excerpt above when she states, "the more plastic they get, the closer they are to dying." In that instance, Starfish appeared to summarize in her own words a series of cause and effect relationships (informed by what she read). In short, she gathered that growing amounts of plastic in the ocean increases the risk of sea turtles dying, which in turn decreases the sea turtle population in the world, and ultimately causes them to be endangered. Frequently, as illustrated here, Starfish reacted emotionally to her constructed summary and expressed a personal evaluation (e.g. "that's not good"). Hence, our characterization of Starfish as "The Aesthetic Summarizer."

Similar to Abby, Starfish spent an additional 13% of her online reading time searching, monitoring, and repairing her understanding of and pathways through online text. Evidence of how Starfish monitored and repaired her comprehension as she negotiated multiple online texts was revealed in a combination of online reading actions and think-aloud verbalizations as illustrated in the following two examples:

- [*Skimming her school's library website for a link to a search engine*]: I can't find the page with Google on it—I'll just type it [the address] in.
- [*Pausing after revisiting a section of text and reading silently*]: I'm kind of like, rereading all of this stuff... I'm wondering about what kinds of things we can do to help them other than just opening up some shoreline for them...Oh, here we go [*sees the heading "Conversation Efforts" and begins reading silently*].

Student responses to the individual reading prompt. In the analysis of students' online reading processes, responses to the prompt were also considered. These responses were formulated to answer the prompt: *Should land be set aside to preserve the leatherback sea turtle?* In Abby's summary, she presented an informed decision, which included several details from her reading to support her reasoning: "I think that, right now, we actually should have a private beach for the turtles. Um...If they just lay it on the beaches, then other people will kick the eggs, and the fisherman will eat them and everything. But if we just have a private beach like just for the turtles, no one would go on it and then the eggs could hatch, and there would be a lot more of them."

Compared to Abby, Starfish provided a much shorter summary, but she successfully addressed the question and offered two pieces of evidence to support her reasoning: "Yes, land should be set aside, because it should be set aside away from...so they can be protected from animals, and predators, so they could have a perfect place to live." Interestingly, Starfish's response lacked the emotional complexity her thinking revealed as she read online. This suggests to researchers and educators alike the importance of examining readers' during-reading processes for richer evidence of their comprehension.

Constructively Responsive Reading Processes Observed in the Collaborative Reading Task

Abby. When reading collaboratively with Starfish to determine what caused the downfall of the Mayan Civilization, Abby spoke 51% of the time in a total of 82 oral statements (see Table 1). She employed processes from all 12 categories of online reading strategies identified in our coding

Two instances where Abby *integrated*, or *synthesized* ideas from different parts of the text and interpreted them in relation to the task were observed as follows.

After reading together from a website about a possible plague that caused disease, and then paraphrasing information about how the Mayan culture thrived until the Spanish monarchy took over, Abby interpreted: "They [the Spanish] probably killed a lot, so that would be another reason of the downfall." Similarly, while skimming information at a website about how the Mayans made sacrificial killings to their gods, Abby shared with Starfish her interpretation in relation to their efforts to determine what caused the downfall of the Mayan civilization: "It [human sacrifices] didn't lead to it, but it contributed to it."

The second more frequently coded strategy in Abby's transcript was *determining important ideas*. Twenty three percent of Abby's total contributions were coded in this way and involved skimming portions of text and paraphrasing orally to her partner. An additional 9% of Abby's comments in the paired reading session involved confirming/clarifying statements for which she confirmed her partner's thinking with comments such as "Yeah" or "I think so" or clarified her own thinking by responding to her partner's question. For example, Starfish asked, "Now where is Guatemala?" and Abby replied, "That's by Mexico, isn't it?"

Other common strategies that Abby used included *evaluating*, or reacting to the text (e.g., "Oh, that's cool!" after viewing a photo of the Mayan ruins), and *monitoring* the relevance of a text in relation to their purpose (e.g., I'm thinking this isn't very helpful). Both processes comprised 7% of Abby's total coded segments. The remaining categories of strategies that Abby used in the paired reading session are summarized in Table 1.

Starfish. When reading collaboratively with Abby, Starfish spoke 49% of the time, making a total of 81 oral statements. She employed 11 of the 12 categories of online reading strategies and, like Abby, her most frequently observed strategy was *integrating* (31% of her total contributions

Table 1. Distribution of Constructively Responsive Online Reading Strategy Use by Category, Reading Session, and Participant

	Individual Reading Sessions		Paired Reading Session		
Strategy Coding Category	Abby (Individual)	Starfish (Individual)	Abby (Paired)	Starfish (Paired)	TOTAL (Paired)
Planning	1 (1%)	4 (2%)	2 (2%)	2 (2%)	4 (2%)
Searching	7 (4%)	8 (5%)	2 (2%)	2 (2%)	4 (2%)
Overviewing	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)
Determining Impt. Ideas	110 (64%)	88 (50%)	19 (23%)	11 (14%)	30 (18%)
Inferring	1 (1%)	4 (2%)	3 (4%)	2 (2%)	5 (3%)
Integrating	8 (5%)	27 (16%)	26 (32%)	25 (31%)	51 (31%)
Questioning	1 (1%)	1 (1%)	3 (4%)	4 (5%)	7 (4%)
Evaluating	14 (8%)	20 (11%)	6 (7%)	2 (2%)	8 (5%)
Monitoring	5 (3%)	6 (3%)	6 (7%)	3 (4%)	9 (6%)
Repairing	13 (8%)	9 (5%)	3 (4%)	5 (6%)	8 (5%)
Reflective Processing	6 (3%)	6 (4%)	4 (5%)	12 (15%)	16 (10%)
Confirming/Clarifying	5 (3%)	2 (1%)	7 (9%)	13 (16%)	21 (13%)

to the dialogue). A coded segment demonstrating Starfish's ability to integrate ideas from different parts of the text to address the task follows.

Starfish: [*reading aloud: "The stone carvings at some sites show ball players with severed human heads dangling from their belts. Do these carvings depict what happened to the losers of a war? What is known is that the ball was a metaphor for the movement of the sun, and by extension also of the moon and stars."*] So, the movement of the sun—whenever the sun moved, they had to sacrifice a person.

Starfish was observed validating Abby's thinking during their collaboration 16% of the time. Statements were coded as validating, for example, when Starfish confirmed Abby's confusion with hyperlinks that led to an irrelevant advertisement ("Yeah, it does things like that sometimes") or when she validated an interpretation Abby made about the text ("Right, like it's coming from the earth").

Reflective processing was another strategy Starfish used frequently, 15% of the time. This strategy was coded when Starfish, together with Abby, deliberately paused to reflect, regroup, and summarize the information they collected so far. In essence, Starfish often paused to create a cumulative list of factors (across multiple websites) that contributed to the downfall of the Mayan civilization. This was demonstrated by comments such as: "So, let's go over this again. Okay...we have droughts, and disease, and other, and the Spanish, and erosion."

Also like Abby, Starfish was frequently observed *determining important ideas* (14% of her total responses). For example, Starfish silently read a paragraph and then paraphrased the most important information that related to the dyad's overall goal: "It [the Mayan Civilization] collapsed in the 9th century ...and the towns and cities were abandoned."

When Abby and Starfish worked collaboratively to gather information about the Ancient Mayan civilization task, they built on one another's ideas, and would often integrate, or come to a shared understanding together, in ways that seemed to help them stay focused on their purpose. The excerpt that follows reveals the social nature of their collaborative reading activity, where confirmatory statements were made as part of the spontaneous dialogue between the two readers.

Abby: Oh, okay [*she emphatically reads aloud*]. The reason for the downfall of the Maya is unknown. However there are several possible reasons for their downfall including soil exhaustion, water loss, and erosion...

Starfish: [*smiles proudly*] It's kind of like the dinosaur!

Abby: [*smiles and shakes head...unintelligible*] I wouldn't have thought of that.

Starfish: [*continues reading*] Other possibilities include catastrophes such as earthquakes and hurricanes, and disease.

Looking across Abby and Starfish's overall contributions to collaborative reading in Table 1, Abby appeared to take the lead when it came to *interpreting* and Starfish appeared to take responsibility for *summarizing* what they had learned and determining whether more information was needed to address the prompt. While both of these strategies were crucial to meeting their final goal, their conscious or unconscious division of responsibilities allowed each student to focus on different aspects and contribute something vitally important, yet different than their partner. In this way, their collaboration was mutually beneficial.

Student responses to the collaborative reading prompt. The prompt did not have one clear or obvious correct answer, yet the students persisted in collecting information from multiple websites to address it. As Abby and Starfish navigated across websites, they co-constructed a list of contributing factors. When asked to sum up what caused the downfall of the Mayan civilization, they both shared what they had learned in an informed and confident manner.

Abby: We think a lot of things contributed to it. There wasn't just one thing. We think that disease, erosion, the Spanish civilization

Starfish: [*Starfish interrupts, to say some of the list*] civilization killed it, and like droughts, and like other natural disasters like hurricanes, earthquakes.

Abby: and also their religion, they sacrificed one person every day so that took a lot of them.

Starfish: Yeah, and water and food shortages.

Researcher: So you felt it wasn't just one thing—that there were a lot of contributing factors.

Starfish and Abby together: Yeah.

In contrast to the responses these students offered in response to the individual prompt, which were less complete, their collective response to the collaborative prompt was more thorough and detailed. This difference in quality suggests that collaboration during online reading may have led to a comprehensive understanding and supported recall of pertinent details.

Reflective interview. Though our findings suggested there might have been some positive benefits associated with reading online collaboratively, we felt it important to collect students' perspectives to come to a richer understanding. During the reflective interview, following the collaborative prompt, students were asked, "How was working in pairs different from working by yourself? What do you think was similar and what do you think was different?" Both students indicated that working together was more beneficial and made the task easier to accomplish.

Abby: I think it was easier, because you wouldn't have to remind me because you'd [*indicating Starfish*] say it, so then I'd...

Starfish: I couldn't have remembered all of those things.

Abby: Yeah, and like, I didn't remember the sacrifice and then she said it.

DISCUSSION AND NEXT STEPS

Results of our analyses revealed that in both the individual and paired online reading sessions, two skilled online readers frequently engaged in determining important ideas, integrating, evaluating, and reflecting while responding to informational prompts on the Internet. These patterns are similar to those outlined in Pressley and Afflerbach's (1995) compendium of reading strategies clustered around processes of identifying and learning text content, monitoring, and evaluating observed when readers interact with offline texts. In addition, we found evidence that both readers frequently engaged in new dimensions of planning, searching, monitoring, and repairing as they negotiated multiple online texts. These data provide tangible examples consistent with Afflerbach and Cho's (2008; 2009) notion that processes of "[illegible]

are dynamically interwoven with more traditionally conceived reading processes. This finding is important for researchers, who examine online reading, and teachers, who teach online reading, to consider since it suggests that an expanded set of strategies appears to be required when reading online. The additional online strategies identified and labeled in our coding scheme may provide guidance for researchers who seek to expand this work. This expanded coding scheme may also inform teachers who seek to design instruction around a bank of useful online reading strategies.

We also sought to explore whether students' interactions within a collaborative dyad would mirror the patterns identified during individual online reading or if different patterns would emerge. Results revealed qualitative differences in patterns of strategy use among students reading individually and in pairs and additional qualitative differences in the pair's collective response to the prompt. When reading individually, Abby was characterized as "The Thoughtful Gatherer" who carefully chose relevant sections of text to attend to and gathered pertinent information as she read. Starfish was termed "The Aesthetic Summarizer" who often expressed concern or empathy as she read. However, when reading in collaboration, those tendencies appeared to shift. For example, in contrast to her performance during the individual task where she was observed *integrating* 5% of the time, Abby *integrated* much more frequently when reading online collaboratively, 32% of the time. Starfish's tendency to *integrate* increased as well from 16% of the time when reading individually to 31% of the time when reading collaboratively. This pattern suggests that as the dialogue unfolded, Starfish was modeling integration for Abby, with Abby ultimately taking up this strategy as her own. Through the act of collaboration, Abby appeared to gradually take on a new role as "The Purposeful Summarizer."

With Abby actively integrating as the pair read, Starfish appeared to become more active in monitoring the pair's reading by engaging in reflective processing 15% of the time and confirming/clarifying 16% of the time. These strategies were rarely coded in Starfish's individual reading session where she engaged in reflective processing only 4% of the time and confirming/clarifying only 1% of the time. This pattern of strategy use may have emerged naturally due to the increased opportunity to work collaboratively. However, Starfish more actively monitored as the pair read collaboratively, and thus took on a new role of "The Reflective Analyzer." Together, Abby and Starfish appeared more efficient in reading reflectively and responding to the prompt.

Consequently, these findings suggest that opportunities to co-construct meaning and responses to prompts that require students to read on the Internet may foster more efficient and productive comprehension of online informational texts—even among readers who are skilled at comprehending online texts independently. This is consistent with work that suggests discussion and shared decision-making facilitates knowledge construction and deeper levels of understanding (Dillenbourg & Schneider, 1995; Mercer, 1995).

As we grapple to understand the constantly changing textual landscape of the digital world we inhabit, we acknowledge that additional research is needed. Our next study will analyze group interaction and functions of collaborative talk through microgenetic lenses (e.g., Rogoff, 2003) and explore the connections between constructivist and sociocultural perspectives of reading comprehension (see Cobb, 1994). Our sample will include additional pairs of students, particularly those who come to partnerships with different background knowledge and varying levels of strategy

This trajectory of work will guide the field to better understand the talents and strategies

required to read skillfully when immersed in the diverse and continually evolving reading contexts found online.

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APPENDIX A

Coding Scheme for Constructively Responsive Online Reading Processes

PRE-READING

Planning
- Activating prior knowledge[1]
- Anticipating the search[2]
- Planning the search[2]
- Identifying search goals[2]

Searching
- Generating a search[2]
- Scrutinizing search result link utility[2]
- Scrutinizing website link utility[2]
- Predicting hyperlink utility[2]
- Generating alternative hyperlink inferences[2]
- Searching to overview[2]

Overviewing
- Overviewing[1]
- Sampling initial texts[1]

DURING READING (within a website)

Determining Important Ideas
- Adjusting[1]
- Reading aloud[1]
- Reading silently[1]
- Skimming[1]
- Predicting[1]
- Paraphrasing accurately[1]
- Paraphrasing with misconception[2]
- Following with cursor[2]
- Highlighting with cursor[2]
- Discussing website images[2]
- Avoiding text[2]
- Sequencing hypertexts[2]

Questioning
- Asking questions about text meaning[1]
- Clarifying text meaning[1]
- Determining word meaning[1]
- Conversing with the author[1]

Inferring
- Inferring[1]
- Connecting key ideas within text[1]
- Connecting key ideas to self[1]
- Connecting key ideas across texts[2]

DURING READING (continued)

Integrating
- Interpreting[1]
- Supporting interpretation[1]
- Reconsidering interpretation[1]
- Reconsidering prior knowledge[1]
- Summarizing for meaning[1]
- Synthesizing[1]
- Remembering[1]

Evaluating
- Evaluating utility[1]
- Evaluating accuracy[1]
- Evaluating author's level of expertise[1]
- Evaluating author's perspective[1]
- Reacting[2]

Monitoring
- Monitoring understanding[1]
- Monitoring strategy use[1]
- Verbalizing strategy use[1]
- Monitoring reading pathways[2]

Repairing
- Changing reading strategy[1]
- Changing reading path[2]
- Reconsidering alternative search[2]
- Selecting additional websites from search results[2]
- Conducting extended search[2]
- Conducting alternative search[2]

Confirming/Clarifying (in response to researcher or partner questions/comments)
- Providing confirmation[2]
- Providing clarification[2]

POST-READING

Reflecting
- Reflective processing[1]
- Planning to use knowledge[1]

[1]Constructively responsive reading processes observed by Pressley & Afflerbach (1995)

[2]Additional processes observed in contemporary think-aloud studies of online reading comprehension