

Teaching online comprehension strategies using think-alouds

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As new information and communication technologies permeate classrooms and libraries, educators have the responsibility to ensure student comprehension.

In classrooms and libraries across the United States and across the world, students are going online to search for information and ideas. Whether driven by personal motivation and interests or a classroom assignment by a teacher, students are using the Internet to locate facts, talk with experts, communicate with one another, and access multimedia. This new technology has caused researchers and educators to question the validity and totality of traditional print literacy to equip students with the skills needed for reading comprehension. The RAND report on reading comprehension accurately assessed, “Using computers and accessing the internet make large demands on individuals’ literacy skills; in some cases, this new technology requires readers to have novel literacy skills, and little is known about how to analyze or teach those skills” (Snow, 2002). How can educators instruct students to become successful in this changing world with skills and strategies for information acquisition and use that will not become outdated or obsolete? How can students be taught to transfer knowledge of one medium to another and to be able to transfer skills from current situations to those yet imagined? As Leu (1997) noted, “literacy

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has become a deictic term; its meaning is continually changing. What it means to be literate has become a moving target, one we can never completely define” (p. 62). Kamil and Lane (1998) were forthright in the statement that researchers “have clearly not addressed the question of what basic cognitive processes are involved in using present technologies related to literacy” (p. 329).

When instruction occurs with traditional forms of literacy, namely reading and writing in print formats, teachers condition students to expect certain characteristics and to employ specific strategies to guarantee success. Typically, print texts are linear, contain a fixed format, are static or unchanging, and contain a limited amount of information. Students are taught to recognize the various styles and genres available in print texts and also to recognize forms and devices used to direct attention, increase retention, or provide illustration. When students move to online environments, many conventions are similar but many others will change. Texts online are often multiline and arranged in a hypertext format. They provide means for interaction and are unconstrained in the amount of information available. Students are generally not taught to recognize the expository nature of the information; they don’t receive explicit instruction in the conventions and devices used to direct attention, increase retention, or provide illustration. Mayer (2000) concluded that researchers and teachers need to know how

students dually process the visual and the verbal material in multimedia and online environments, and how students build dual mental representations of the visual and the verbal (p. 373). Students are often taught to navigate the Web and use online sources without being taught to comprehend the process of information selection or evaluate the quality of the content presented and think metacognitively about their seeking strategies. This is similar to teaching students to decode print text without teaching them cognitive strategies for comprehension or metacognitive strategies to internally control learning and processing. Burke (2002) claimed that both children and adults mistake the ability to move around on the Internet as the ability to read and comprehend the information therein. As noted by Schmar-Dobler (2003), educators should guide students toward success by allowing them to apply existing knowledge of texts to online environments. We, as teachers, are doing a fine job of teaching students to navigate the Web, but we are not instructing them on how to understand what they are doing, and we are certainly not teaching them to think metacognitively about their research strategies and information-seeking behaviors. So the question emerges, “How can educators increase student comprehension in online reading and information seeking?”

Research on think-alouds

One answer is the use of online think-aloud strategies. The think-aloud is a technique by which the individual voices her or his thoughts during the performance of a task. It is simply what it appears to be—someone thinking out loud. In the area of computer-interface design, the think-aloud has been used to provide information about user cognition and processing during task performance or problem solving. The think-aloud has allowed designers and programmers to know how the user will develop strategies and what encourages success or creates failure for the individual. Initially, the think-aloud was used in the field of literacy as a research technique to

study reading processes. More recently, the think-aloud has been used in classrooms by teachers as an instructional and assessment technique, due to its relative ease of implementation and use. In their review of print-based think-aloud studies, Michael Pressley and Peter Afflerbach recognized the ability of such protocols to provide information about the reader’s goals; text processing; affective response; and controllable, conscious comprehension, as opposed to other comprehension strategies such as schema and propositional theories (cited in Pressley, 2000). Pressley and Afflerbach noted that strong or skilled readers generally use a variety of strategies, including

- awareness of purpose;
- skimming or scanning text to determine relevance to purpose;
- reading selectively, focusing on sections relevant to purpose;
- making associations with new ideas to prior knowledge;
- making assumptions and hypotheses and then revising them, if necessary;
- maintaining a dialectic between new ideas and prior knowledge and revising prior knowledge that is inaccurate based on text or rejecting new ideas from text that are inconsistent with prior knowledge;
- discovering new meanings of words;
- rereading or note-taking to remember key ideas;
- questioning and interpreting or paraphrasing text to the point of having imaginary conversations with authors;
- evaluating text structure and quality;
- reviewing; and
- thinking about how to use the information in the future.

In teaching students to participate in online think-alouds, many, if not all, of these strategies can be used to ensure comprehension of information. Teachers must model and scaffold these

strategies for students as they are taught and implemented. When the strategies are successfully employed in online environments, students are in control of their own information-seeking behaviors and are able to obtain, process, and disseminate ideas.

Print versus online environments

Awareness of purpose. A student's awareness of purpose is critical to her or his comprehension of the text. Is the student reading to find pleasure, to answer questions, to be convinced of a political viewpoint, or simply to obtain new information? Likewise, a student must be aware of her or his purpose in reading online and seeking information in the online environment. Because of the sheer volume of text online, a student can easily become overwhelmed. The nature of hypertext can cause the reader to follow endless links and become sidetracked from her or his original purpose in short order, possibly causing a problematic and convoluted return to the original query. In the online environment, Sutherland-Smith (2002) stated that a clear purpose can be most useful to students who have poor technical and task orientation skills. Research on user studies has shown that individuals without this awareness of purpose often make false starts, follow erroneous tangents, get frustrated quickly, and often guess out of desperation (Brandt, 2000).

Skimming, scanning, and reading selectively. With printed text, readers may skim or scan to determine length, organizational format, and key passages that might relate to the purpose of the reading activity. Generally, it is preferable for readers to follow the author's idea from beginning to end and avoid selective reading by skipping around and jumping from idea to idea. However, Kamil and Lane (1998) argued that such useful and necessary strategies from print environments are "not effective and may be even dysfunctional in reading hypertext" (p. 329). Due to the volume of text online, it is necessary for

students to become proficient at skimming and scanning for information. This may be, in fact, how users read on the Internet—not reading word by word but rather by taking a snatch-and-grab approach to locating and using information. In a study of the reading habits of online users, Jakob Nielsen and John Morkes (cited in Nielsen, 1997) found that 79% always scanned for information. They concluded that effective online resources must employ techniques that are conducive to these strategies of skimming and scanning by highlighting words, organizing information in bulleted lists, creating meaningful headings and subheadings (rather than creative or clever ones), and organizing ideas in an inverted manner, with conclusions and major propositions stated initially.

Activating prior knowledge and maintaining the dialectic. Although prior knowledge may be activated automatically as explained by schema theory, the knowledge network, or cognitive patterns guiding reading (Pressley, 2000), it is beneficial for the reader to consciously relate new ideas encountered in the text to her or his existing knowledge of the same or similar topics. Concurrent with awareness of purpose, the reader should consider the relevance of her or his prior knowledge of the subject, the author, the text style, and other factors. This knowledge allows the reader to make assumptions and hypotheses that can be checked and verified or revised based on the introduction of new ideas and information. In the online environment, it is equally important that the reader or searcher consciously activate her or his prior knowledge. Because text, images, and information online are often less explicit and seldom elaborated, the reader must have a framework in place by which to organize or categorize new ideas and new knowledge. In order to maintain the dialectic, students must be able to assess the accuracy of the information obtained. The facts may be distorted by a political or social agenda, or they simply may be incorrect. If the information is wrong, students may choose to reject it as inconsistent with their prior knowledge. If it is determined to be authoritative, students

may choose to revise their thinking based on the new ideas.

Discovering new meanings of words. In a traditional print environment, the discovery of new word meanings might be through the use of contextual clues, morphological awareness, or the use of external reference materials. Online, the reader might use the hypertext links to access a dictionary or alternate pages with detailed information, diagrams, or other images that explain and elaborate definitions and related concepts. Reinking and Bridwell-Bowles (1991) reviewed the use of computers and comprehension aids to determine that these online aids did indeed increase comprehension for college students. In addition, they found that younger students understood readings better when the use of such comprehension aids was required. Meyer and Rose (1998) believed that vocabulary support in computer-mediated environments allows students to focus more attention on meaning and on related comprehension strategies such as predicting and clarifying.

Rereading and note-taking for retention of key information. Many practitioners value the use of rereading to increase comprehension. Educators also spend much time and energy teaching students note-taking strategies, such as outlining, and multiple strategies for creating graphic organizers to increase understanding and retention of information. Online, the user may print information as necessary, either page by page or through a cut-and-paste methodology that mirrors the snatch-and-grab philosophy used to locate the information initially. Sutherland-Smith (2002) noted that the concept of rereading should also be taught to students who are using the Internet. Because students often snatch, grab, cut, and paste information with little thought, she suggested reinforcing the idea that students must read the information more deeply and in a more detailed manner to increase understanding after printing, saving, or bookmarking it.

Interpreting or paraphrasing text and “conversing” with the author. In the reading of print texts, readers ask and answer questions, mentally

restate main ideas and key concepts as they are negotiated to fit with existing knowledge, and mentally (though occasionally verbally or subvocally) paraphrase information to check comprehension and clarify ideas. Unrau (2004) brought up the notion of intertextuality in the comprehension of text. This theory can be applied in print and online environments because it indicates an ability to make connections with other forms of cultural communication and texts, such as art, movies, or television. Likewise, Lemke (1998) noted that we make meaning by “connecting the symbols at hand to other texts and other images read, heard, seen, or imagined on other occasions” (p. 285). When reading online, the reader must also continually ask questions and keep those at the forefront to guide her or him on the navigational process. By repeatedly interpreting ideas and paraphrasing the text, the reader is able to quickly and efficiently accept or disregard information. In the online environment, the reader does not necessarily have to conduct an imaginary conversation with the author to check her or his comprehension and understanding of the ideas through questioning but might actually be able to converse and discuss the ideas with the author and other experts via e-mail, asynchronous postings, or live chats. In addition, the text itself as it appears on the screen can be altered in response to the reader’s input or manipulation (Labbo, Reinking, & McKenna, 1998).

Evaluating text structure and quality. The RAND report on reading comprehension (Snow, 2002) suggested that readers who do not understand the structure of texts often fail to develop an action plan and therefore retrieve information in a random manner. Unrau (2004) stated that the knowledge of text structure allows the reader to discover organizational patterns and organize a mental representation of the information from the text. In the essay “Flies in the Web of Hypertext,” Purves (1998) noted that perhaps the online medium is just now forcing the reader to ask questions and rethink assumptions that should have been asked all along in print environments. Strategic readers are aware of the text

structure and implied authority of the author. They focus on the organization of the writing and search for the cohesiveness of the argument and the logical arrangement of facts and ideas. Online, this is a critical step. The reader must look for clues that would indicate a less than reputable source and look for bias and fallacy in the argument. Is the information only one person's unsubstantiated opinion, or does the information provide evidence of careful, documented research (Burke, 2002)? The reader must ask herself or himself whether the source can be trusted and whether the quality of the information is consistent internally and verifiable through other sites or sources of information. Britt and Gabrys (2001) concluded that the ability of students to integrate, source, and corroborate information and documents found online is lacking and requires explicit instruction. In addition, students must evaluate nontextual features presented in the information and decide whether they add or detract from the facts of the argument.

Reviewing information. In print environments, as the reader encounters new ideas, organizes them into existing frameworks and creates new mental models, interprets them according to a predetermined purpose, and determines relevance and authority, she or he begins to process the information and to think about ways of dissemination and means of transfer of that new knowledge. Block and Pressley (2003) included summarizing in this step, as the reader deletes irrelevant details, combines similar ideas, condenses and restates main ideas, and connects themes into usable statements according to the initial purpose for the reading activity. Meyer and Rose (1998) explained the benefit of interactive technologies in these processes of review and use:

Digital text, like raw clay, can be shaped and reshaped. It invites manipulation. The new medium offers new opportunities to learn about text by changing it and evaluating the results. Electronic text invites students to enter a piece of writing and make themselves at home in it, developing a sophisticated understanding of what text is all about through a hands-on experience. (p. 49)

Mayer (2000) defined *literacy* as “making sense” of multimedia messages created by others and creating messages that can be understood by others. This definition emphasizes the relationship between what is learned and what is communicated. Greater understanding of the information through increased comprehension allows students to create innovative uses for their new knowledge gained from and dispersed through technology.

An online think-aloud?

The think-aloud, when used in connection with print texts, allows teachers to “hear” and evaluate students' comprehension. It provides insight on the strategies used to make meaning for the student. When students are taught to use the think-aloud, they are instructed to voice all of their thoughts about, feelings toward, and understanding of the text. The teacher will instruct the students to state their purpose, relate their prior knowledge, make assumptions and predictions, check predictions, ask questions, evaluate the text structure, and consider how to communicate the information learned. Wilhelm (2001) noted, “think-alouds are a means to an end—an end that is engaged and reflective reading” (p. 16). Use of the think-aloud will benefit students by showing them that reading is a meaning-making process, involves the use of strategy, and is a skill that can be developed through sharing with others and individual self-reflection (Wilhelm). Berk (1994) noted the success children have in the mastery of new skills and behaviors when allowed to verbalize thoughts. She stated, “whenever we encounter unfamiliar or demanding activities in our lives, private speech resurfaces. It is a tool that helps us overcome obstacles and acquire new skills” (p. 79).

Applying the think-aloud to an online environment may not be as novel as it seems. Such verbal protocols have been successfully used with a variety of media to investigate mental processes (Shapiro, 1994). However, its application as an instructional and assessment tool, rather than a usability or design tool, may well be a new

approach. When instructing students to use multimedia and online information and communication technologies, teachers could benefit from the think-aloud similarly to know which information-seeking strategies and which reading comprehension strategies were used jointly by the student to develop understanding. As with the think-aloud in print, the goal of the online think-aloud would be to develop students who are

active and engaged and reflective about their strategy use. Table 1 shows a comparison of how three of the strategies used by readers with print texts could similarly be used and applied online.

Instruction in the think-aloud strategy must be modeled. A teacher can use an Internet connection and screen projector to demonstrate to students not only how to physically navigate through

Table 1
Comparison of reading strategies

Awareness of purpose

Print texts:

“I need to find a quote or a fact that will support my ideas about what should be done about acid rain.”

Online texts:

“I need to log on to the Web and do a Google search to find information about acid rain. Maybe there will be a chart or graph or something else that will help too. If I can’t find that with Google, I might need to use a different search engine that will let me search specifically for multimedia besides just text. I need to be careful not to get distracted by anything that is flashing, or by chasing links, or even checking my e-mail, because I don’t have too much time today.”

Discovering new meanings of words

Print texts:

“I don’t know what that word means. It seems like it is important because it is used several times in the next few sentences. Let me reread that to see if it makes more sense. Was it explained earlier and I missed it or is the definition coming up? If I can’t figure this out, I am going to need to get a dictionary, check the back of this book, or ask someone else for help.”

Online texts:

“I am not really sure what that word means. Let me click on it—it’s blue so I think there is a link to something else. Hopefully it will tell me what it means or send me somewhere else where the word is explained better than it is here. I just don’t want to go away from this page too far and forget where I am!”

Interpreting the text and conversing with the author

Print texts:

“I wonder if there is something in this author’s background or experiences that has made him write the text this way? I guess I will have to ask the teacher or try to find a biography or another book or article that talks about the author and why he writes this way.”

Online texts:

“I wonder why the author said that. Maybe there will be an e-mail address somewhere on this page where I can write and ask him. Or maybe there is a bulletin board where I can look to see if anyone else has ever had this same question before....”

a website but also how to mentally navigate through the information presented. When the teacher gives voice to her or his thoughts in the think-aloud while searching for facts or reading information on the website, the students are able to watch, listen, and learn about comprehension processing behaviors. If the teacher explains not only what she or he is doing but also why, for what purpose, and how understanding of the information is gained and assimilated, students begin to learn about metacognition and analyze their own thinking strategies and patterns. When explicit instruction occurs, students realize that these are the “secrets” of good searchers and good online readers. The teacher is able to explain, model the strategy, and teach the strategy for students to use. A teacher must explicitly voice the strategy (skimming and scanning or evaluating text structure) and explicitly model the process used to understand or comprehend. The teacher should additionally make intentional missteps similar to those the student would make (following incorrect links or misunderstanding structural functions) to model the ability to recognize mistakes, retrace steps, and get back on track. Using the think-aloud techniques with online texts should be viewed in the same way as with print informational texts. The forms, structures, and conventions are explained by the teacher as the think-aloud process is demonstrated and modeled.

Online forms of literacy should be held to the same standards as print forms of literacy. In all texts, literacy must be seen as comprising skill and strategy: a mix of complex cognitive and metacognitive processes used to create meaning and empower the individual. Similar to a think-aloud in a print environment, using the think-aloud online is a method of passing the “strategy torch” from the teacher to the student. As the teacher demonstrates or models the online think-aloud with the students, they should be encouraged to note the types of questions and strategy implementations the teacher is making, which must eventually be generated in their own minds. As an intermediary step, teachers should encourage students to focus on mastery of one or two

strategies at a time. Students may then confer with the teacher or a peer and begin to share their “secrets” for locating and using information when reading online. This form of dyadic instruction allows teachers to first make their thought processes obvious and explicit and then let the student reciprocate by demonstrating their attempts at strategy implementation. When students are able to demonstrate success in the use of online think-alouds, they can begin to internalize the strategies required by their information-seeking and online reading behaviors.

To date, there are no published empirical studies that demonstrate the effectiveness of this technique. However, reading research has proven the think-aloud to be an effective method of developing comprehension (Pressley, 2000; Wilhelm, 2001), and usability studies have proven the think-aloud to be effective in explaining strategy implementation and decision making in online environments (Brandt, 2000; Nielsen, 1997; Shapiro, 1994). Therefore, scientific research, cognition research, and reading research combine with usability and programming studies to suggest that an online think-aloud can be a powerful way to improve student comprehension of material read and learned in online environments. Anderson (2000) noted that teaching students to regulate their learning is a “long-term endeavor requiring modeling and explanation of mature thought embedded in an extensive practice of doing interesting and authentic tasks with appropriate scaffolding” (p. 59). The technique of the think-aloud can and should be used with students to allow them to begin to think metacognitively about their information-seeking behaviors and processing of information gathered in online environments. While some caution that other factors such as motivation and skill may inhibit the development of metacognitive strategy implementation gained through processes such as the think-aloud (Smith & Ragan, 1993), this is not so when students are encouraged to use computers and the Web to locate information and read for a task. Students generally are quite confident about their abilities to navigate online and to locate information. After

direct instruction and modeling by a teacher using the think-aloud procedure, many students may be surprised by their level of expertise at reading and understanding online texts. Teachers can additionally demonstrate the connections between online and traditional print texts.

Implications for practice

Comprehension research has indicated that explicit instruction in cognitive strategies and controlling mechanisms allows students to monitor and adjust their processing of information encountered through texts (Pressley, 2000; Snow, 2002). This should be applied to online texts as well. Leu and Leu (1997) argued that the Internet, or online resources, will increase, not decrease, the central role of the instructor in orchestrating learning experiences for students. Kramarski and Feldman's (2000) study indicated that technology or use of online resources does not itself increase student comprehension. For students to develop higher levels of understanding, explicit or direct instruction in metacognitive strategies that regulate self-awareness, self-control, and self-monitoring are necessary. Only with specific instruction will students be able to use the technologies, such as online information sources, effectively and productively. Teachers must design metacognitive strategies as an integral part of the use of technology (Kramarski & Feldman). Yet Kamil and Lane (1998) observed that teachers devoted little time to adapting literacy instruction to available technologies, due to time and training constraints. Just as in print environments, teachers must instruct readers to become active and strategic (Block & Pressley, 2003); in the online environment, teachers must provide students with tools to become active and strategic in the location, reading, cognitive processing, and use of information. However, Block and Pressley warned that in order for the majority of teachers to implement think-aloud activities, intensive professional development is necessary. If this is true in print environments, where reading and comprehension instruction has placed its focus for decades with

materials that are "comfortable" to teachers and readily used, the necessity of professional development is even greater with the additional facet of computer technologies, considering the levels of discomfort and inaccessibility of technologies by some teachers. Coiro (2003) noted that realization of the potential of Internet technologies can only come about when teachers have the opportunity to develop their own skills and plan for technology that promotes reading comprehension. Grisham (2001) stated that although teachers are more important than technology, "it is the well-informed and technologically literate teacher who judiciously uses technology as an instructional tool" who is best able to meet the needs of learners. In the classrooms of tech-savvy, effective teachers, the use of online think-aloud strategies may prove to answer questions and provide research scenarios to determine how to instruct students to comprehend and use information from new and emerging technologies.

Teachers who use this type of instruction should note greater levels of success in their students' use of online resources and more focused attention to strategy when students are seeking information. Students who are successfully taught to employ strategies when seeking information and reading texts online will assist educators and researchers who continue to struggle with new texts and forms of them. Success with strategies will additionally affect areas such as usability, interface design, and information architecture. Only when we truly understand how readers process hypertext, how critical judgments are made online, and what strategies are routinely employed by information seekers and readers will we be able to know which skills and strategies are needed for success in online environments. Then it will be possible for educators to plan for instruction as students encounter developing technologies. Do students need to be taught to apply the same strategies as in print environments? Does the online environment require a set of new strategies for comprehension? How does focused attention to strategy improve success? Can this success be measured and quantified? What kinds

of skills do students routinely employ when seeking information? Do students who are more adept at strategy implementation with print texts also experience greater success online? The simple use of technology alone will not create students who are self-reflective and critical thinkers, able to employ strategies to guide their processes. These abilities must be modeled, scaffolded, and taught by educators who are knowledgeable about emerging technologies and who have internalized best practices of literacy instruction.

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