Another Look at the Schema Effect on Comprehension

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Introduction

Since there has been a shift of focus from reading products to reading processes, a great number of researchers indicate that comprehension involves an interaction between a reader and a text (Crawford & Chaffin, 1988; Pritchard, 1990; Carrell & Eisterhold, 1993; Goodman, 1993; Carrell, 1993). This interactive model posits that meaning is constructed from the interaction between a reader and a reading material (Anderson, 1977; Rumelhart, 1994). Effective readers employ their background knowledge, past experience, and anticipation as well as linguistic elements such as letters, words, and forms to comprehend texts. Reading comprehension does not rely on linguistic units or background knowledge only. The reader uses both kinds of knowledge to comprehend a reading material at hand.

This view of reading addresses the importance of background knowledge or schema on comprehension. The readers integrate their prior knowledge and experiences with textual information. The success of comprehension depends upon the match between the readers' knowledge and the information in the text. That is to say, the more the readers can relate their world knowledge with that of the author, the better the comprehension (Carrell, 1984b; Carrell, 1984a). In addition, when the readers process texts which are culturally familiar to them, they relate more background knowledge and are able to comprehend more (Chihara, Oller, & Sakurai, 1989; Pritchard, 1990). Although several empirical studies point to a facilitative effect of schema on comprehension, some studies argue that prior knowledge may interfere with, rather than facilitate, reading comprehension under

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certain conditions. Accordingly, the paper discusses both positions and the conditions under which a schema may cause comprehension failure. Such discussion should be beneficial for researchers, instructors, and readers who should be aware of possible factors which may lead to failure in comprehension.

Schema Theory

According to schema theory, a text does not have meaning in itself, but rather provides directions for the readers so that they can retrieve or construct meaning from their previously acquired knowledge. This previously acquired knowledge is called the reader's background knowledge or schema and the previously acquired knowledge structures are called schemata (Adams & Collins, 1979; Rumelhart 1980; cited in Carrell, Devine, & Eskey, 1993). The theory indicates that comprehending a text is an interactive process between the readers' background knowledge and the text. When the readers encounter new information, they attempt to understand it by fitting it into what they already know about the world. Such knowledge is the mental structures stored in memory or schemata. When they come across something which is novel and does not fit into an existing schema, they go through a process of adjustment in order to deal with the new input so that all aspects of that schema are compatible with the input information. This principle results in two basic modes of information processing: top-down and bottom-up processing. Top-down or "knowledge-based" processing involves predictions about the text based on prior knowledge, and then checking with the text to confirm or refute predictions. On the other hand, bottom-up or "text-based" processing is decoding linguistic units, building meaning from the smallest to the largest units, and adjusting background knowledge and current predictions based on information in the text (Carrell, 1993, p. 102). Skilled readers change their modes of processing according to the demands of the text and the reading situation. Less proficient readers, however, overrely on processes in one direction, which results in comprehension failure (Spiro, 1978, 1979).

The following sample from Fillmore (1981) illustrates overreliance on text-based and knowledge-based processing: "The princess ate some jam. The queen slapped her. The princess began to cry" (p. 102). If a reader overrelies on text-based processing, he or she would understand that somebody who is a

princess ate jam, someone who is a queen slapped a woman, and someone who is a princess cried. If, however, the reader uses knowledge-based processing, he or she would notice a coherence in the text. The reader may assume that the princess in sentence 1 and 3 and "her" refers to the same person. Next, the reader may associate these three sentences with a royal family schema and assume that the queen in sentence 2 is the princess's mother. At a higher level of thinking, the reader may interpret the text from their knowledge of human characteristics. For instance, he or she may speculate that the queen punishes the princess because of her misconduct (eating the jam). The princess, then, shows pain through the act of crying. Furthermore, the reader can add details which are not mentioned in the text based on their personal knowledge. For example, the queen is greedy and had wanted to eat the whole bottle of jam. This is a sample of the reader's overreliance on knowledge-based processing.

In order to help us understand the role of schema availability in English as a Second Language (ESL) reading, Carrel (1993) draws a distinction between formal schema and content schema. Formal schema is "background knowledge of the formal rhetorical organizational structure of the text," whereas content schema refers to "background knowledge of the content area of the text" (p. 104). In other words, formal schema includes background knowledge and expectations of differences in rhetorical structure in genre such as structure of fables, short stories, essays, and academic texts. For instance, our schema for short stories includes the anticipation that this type of genre has a beginning, a development, and an ending. Mandler (1978) also differentiates between schemata for causal connections and chronological links. For expository texts, Meyer and her collegues (Meyer, 1975, 1977, 1981; Meyer & Rice, 1982; Meyer & Freedle, 1984) report five different types of expository rhetorical organizaton: (a) collection (list), (b) causation (cause and effect), (c) response (problem and solution), (d) comparison (comparison and contrast), and (e) description (attribution). They further explain that each of these types represents different schemata of how the writers compose and how the readers comprehend main topics.

Content schema, on the other hand, points to background knowledge about the content area of a text, such as a text about doing laundry, eating in a Italian restaurant, celebrating Thanksgiving in New York, and so forth. To

illustrate the effect of background knowledge, consider the following sentence: "The policeman held up his hand and stopped the car" (Collins & Quillian, 1972; cited in Carrell, 1993, p. 77).

In trying to understand the above sentence, we relate to something familiar. Our thoughts lead us to several schemata possible, but the most likely interpretation is a traffic officer who is signaling to a car driver to stop. When we interpret this sentence, knowledge of a particular schema is not mentioned literally in the text. We imagine that the policeman signaled to the car driver and the driver put on the brakes, which later caused the car to stop. The information we infer from the text is our prior cultural knowledge about the way traffic police communicate with automobile drivers. Our interpretation would change if the policeman were a superman and the car were without a driver. This latter interpretation involves the use of a physical act to stop the car, which reflects a completely different schema. Based on this discussion, Carrel further sets the following reading comprehension questions and provides answers which depend upon which of the two schemata is activated in the reader's mind:

Table 1: Different Schemata (Carrell, 1993, p. 78)

Question	Answer	
	Traffic cop schema	Superman schema
(a) Did the policeman's hand touch the car?	No	Yes
(b) Were the car's brakes applied?	Yes	No

The effect of formal and content schemata on second language reading comprehension

Research on reading comprehension has shown that not only the effects of sentences or paragraphs, but also the overall rhetorical organization have an impact on comprehension. Different types of texts such as stories, fables, expository and scientific texts have their own conventional structures. The readers who possess such knowledge of conventions are likely to comprehend and recall

texts better than those who lack such knowledge. This knowledge has been called formal schema. Carrell (1984b) examined the effects of a narrative formal schema on reading in English as a Second Language. The researcher hypothesized that if English as a Second Language subjects were influenced by story schema[1] quantity of recall and temporal sequence[2] of recall would be affected when they read the stories which violated the expected story schema. The findings suggested that the nature of the texts (well-structured vs. badly-structured versions) has an effect on the quantity and temporal sequence of the subjects' recall. When the story's rhetorical organization was well-structured according to a story schema, the subjects' quantity of recall increased. In addition, the subjects' recall of the stories whose episodes were not well-structured showed a strong schema effect. That is, recall seemed to reflect the story schema rather than the violating sequence of events.

Besides investigating the effect of story schema on second language reading, Carrell (1984a) reported the effects of four different English rhetorical patterns on the reading recall of English as a Second Language readers of various native backgrounds. The texts, which contained identical content information, were structured in four different expository patterns: comparison, causation, problem/solution, and collection of descriptions. The findings indicated that the subjects could recall more specific ideas of the highly structured types of discourse (comparison, problem/solution, and causation) than those of the less organized pattern called collection of descriptions. Such findings implied that, if the readers possessed the formal schemata of the more highly structured types of discourse (comparison, problem/solution, and causation), these more highly structured types of organization could facilitate encoding, retention, and retrieval of information. Another interesting result was that only about one-fourth of these subjects utilized the discourse structure of the text in their recall. This finding suggested that reading instruction should emphasize the identification of varied discourse structures to facilitate the readers' comprehension, retention, and recall.

In addition to formal schema or knowledge on the rhetorical structure of the text, another component which affects comprehension is content schema or prior knowledge on the content area of the text. The studies reviewed above suggested the facilitative effect of the reader's knowledge of the structure of the

text on comprehension. Other researchers pointed to the importance of content schema on comprehension as follows. Chihara, Oller, and Sakurai (1989) examined whether the texts modified to be more culturally familiar to English as a Foreign Language readers affected their reading comprehension. The researchers hypothesized that the subject's cloze scores would increase if the culturally unfamiliar terms were changed to familiar ones. The results of the study confirmed such a hypothesis--the subjects' mean scores increased when they read the modified texts. These findings implied that changing a few unfamiliar elements into more familiar ones produced a significant difference in reading comprehension.

Similarly, Pritchard (1990) investigated the role of content schema on reading with emphasis on the effect of cultural familiarity on the readers' use of strategies and comprehension. The subjects in this study were from the United States and from the Pacific island nation of Palau. These subjects read both culturally familiar and unfamiliar passages in their own language and they were later asked to give verbal reports of their reading strategies and retell the passage after reading. The findings showed that cultural schemata seemed to influence the readers' processing strategies and the level of comprehension they achieved. When they read the culturally unfamiliar passage, they used the strategies *developing awareness*[3] and *establishing intrasentential ties*[4] significantly more often than when they read the culturally familiar one. On the contrary, when reading the culturally familiar passage, they employed the strategies *establishing intersentential ties*[5] and *using background knowledge*[6] significantly more often. Moreover, the subjects recalled significantly more ideas and produced more elaborations for the culturally familiar than for the unfamiliar passage. These findings indicated that reading was a "content-specific" activity. When the content of the reading material changed, the readers' processing behaviors changed as well (p. 291).

Even though all of the studies discussed above reported the effect of formal and content schemata on reading, the following studies indicated no significant effects of such schemata on second language reading comprehension. Carrell (1983) investigated the individual effects of these three separate components of background knowledge: (i) prior knowledge in the content area of the text (familiar vs. novel); (ii) prior knowledge which informs the reader in

advance of the content area relative to the text (context vs. no context); and (iii) degree to which lexical items within the text provide textual cues to the content area of the text. The researcher examined the effect of these three components of background knowledge on both native and nonnative English as a Second Language readers. The findings showed that the three components of background knowledge played a significant role in reading, understanding, and recalling a text for native English readers. However, nonnative English readers did not utilize context or textual clues to arrive at comprehension and only advanced English as a Second Language readers recalled information better when reading the familiar text. These findings suggested that English as a Second Language readers tended to be "linguistically bound" to the text (p. 200). They might put emphasis on the literal language of the text, but did not make the necessary connections between the text and relate appropriate background knowledge to the information in the text. When given an explicit context and lexical items which provided textual cues, they did not utilize such background knowledge.

Alvermann et al. (1985) also examined the effect of prior knowledge activation on the readers' comprehension of texts containing information which is either compatible or incompatible with their prior knowledge. The subjects were sixth-grade native English speakers. The results indicated that the subjects who activated relevant background knowledge, prior to reading texts which consisted of information that was incompatible with their existing background knowledge, tended to rely more on their previous knowledge than the textual information. As a result, they recalled less information in the texts. Such results suggested that prior knowledge might interfere with reading comprehension under certain conditions. Regarding the finding of no facilitative effect of formal and content schemata, the following section attempts to discuss explanations of comprehension failure.

Failure to Comprehend

Garner (1987) and Rumelhart (1980; cited in Clarke, 1990) provided three causes for failure to comprehend. First, the text clues may not be adequate to activate the readers' schemata. The text may contain poor quality of input as often seen in an incoherent text, or the memory may lack the necessary structures such as word recognition ability or linguistic knowledge. Second, the reader may not

have appropriate schemata, or what he or she has may be incomplete. To solve such a problem, the reader could modify or create schemata by means of "accretion," "tuning," or "restructuring" (Rumelhart, 1980; Garner, 1987; Norman, 1982; cited in Clarke, 1990). Accretion involves adding new information to preexisting schemata. It does not create a new schema, but the one in place becomes more adaptable. Tuning makes concepts either more specific or general. Specific concepts "facilitate faster with detailed interpretations." On the other hand, general concepts "permit interpretations of more varied situations" (p. 18). Both accretion and tuning do not create new schemata but rather adapt old ones. However, restructuring or copying an old schema by analogy can create a new schema (Garner, 1987). Restructuring also requires a major change in position. "Cognitive dissonance" or reading the text from different perspectives was suggested as a practice for restructuring (McNeil, 1987; cited in Clarke, 1990, p. 18). A third failure to comprehend may result when the reader makes an interpretation not intended by the author (Anderson, 1984; Pace, Marshall, Horowitz, Lipson, & Lucido, 1989; McNeil, 1987; cited in Clarke, 1990). As discussed in the first cause of failure to comprehend, sometimes the unclear or misleading text can create miscomprehension. Nevertheless, misinterpretation can arise from the reader. If the reader cannot correct such misinterpretation, misunderstanding may occur.

It may become clearer now that schemata or preexisting background knowledge can interfere with comprehension as well as aid it. This knowledge may be affected by personal beliefs and other affective and sociocultural influences. Some of these inferences can be quite resistant to change (Clarke, 1990). Reading researchers and instructors should take all of these possible causes of miscomprehension into consideration.

Instructional Implications

As discussed above, schemata may have both positive and negative effects on comprehension. Therefore, reading instructors should be aware of factors that lead to comprehension failure. It may be worthwhile for the instructors to engage the students in various types of background knowledge activation activities and to assess the students' preconceived ideas about a topic to

find out whether such ideas are inconsistent with the information in the text. The instructors can encourage the students to form expectations for the content they are supposed to read. The students can skim the text and look for any helpful clues such as titles, headings, subheadings, pictures, captions, and introductory statements. They should also be alert for anything that gives them clues to content. After that, they predict the content and tell their partner what they think the text is about. This prediction phase prepares the students to read actively for meaning. They can later compare their prediction with new information in the text and finally adjust their schemata to include new data from the text. Another method to activate schemata is to give the students prereading suggestions or questions that orient them to look for certain structural clues or cultural factors which are different from theirs (Melendez & Pritchard, 1985). In addition to determining whether the students' existing schemata are in conflict with the information in the text, the instructors must also be prepared to show the students how to better use their texts in resolving the conflict. For instance, the instructors can use "adjunct questions" which require the students to interact with the text (Melendez & Pritchard, 1985, p. 402). These generated questions are embedded in the text and they may appear at the point where the instructors want the students to reflect on what they have read. Such activity encourages the students to monitor their comprehension while reading. After the reading, the instructors can promote the students' higher level thinking skills through questions which include an awareness of all levels of comprehension. This can be accomplished by use of open-ended questions which require the students to "infer, evaluate, and justify their conclusions" (Melendez & Pritchard, 1985, p. 402). Next, the instructors can use a "semantic web" (Widomsky, 1983). This helps the students gain an overall understanding of what they have just read. The students have to select key words or phrases from a text and organize them in a visual display that portrays their understanding of the text. Furthermore, the instructors can ask the students to compare their semantic webs with their predictions made earlier and discuss what parts of the webs support earlier predictions and what parts are in contradiction to the information in the webs. Such checking can reduce the misinterpretation that may occur from their existing background knowledge.

Conclusions

Even though schema or prior knowledge is one of the important factors which facilitates comprehension, those who apply such knowledge should be cautious of the problems which lead to comprehension failure as well. The readers' failure to activate appropriate schemata (formal or content) during reading may result in various degrees of miscomprehension. This failure may be due to insufficient clues provided in the text for the readers to effectively utilize the bottom-up processing mode to activate schemata the readers already possess. Also, the failure may be due to the readers' inappropriate schemata or their misinterpretation of the text. Both instances point to a mismatch between the writer's anticipation of what the readers can do to construct the meaning of the text and the readers' ability to do such. Therefore, schemata can aid comprehension only when the readers possess appropriate schemata and interpret the text as intended by the author. Further studies should investigate the effect of schema activation on the readers' understanding of the text so as to find the effective ways to strengthen the readers' comprehension. Moreover, the studies should assess the readers' preexisting background knowledge and explore the extent to which this knowledge causes failure in comprehension when the knowledge is inconsistent with the information in the text.

Foot Notes

[1] A story schema is a rhetorical structure or the grammar of a story. Each story consists of a common Setting plus an Event Structure, which consists of a series of causally or temporally connected Episodes. Each episode consists of a Beginning, a Development, and an Ending. The Development consists of a Reaction and a Goal Path, which, in turn, consists of an Attempt and an Outcome (Carrell, 1984b, p. 90).

[2] Temporal sequence is the order in which the story nodes were recalled. For instance, Episode I should be recalled before Episode 2 (Carrell, 1984b, p. 100).

[3] Strategies in this category relate to the subjects' awareness of how much progress they were making and of any problems they were encountering as they read the passages (p. 281).

[4] Strategies in this category relate to the subjects' attempts to develop an understanding of the particular stimulus sentence they were reading only (with no effort to relate the stimulus sentence to other portions of the text) (p. 281).

[5] Strategies in this category involve relating the stimulus sentence to other portions of the passage (p. 281).

[6] Strategies in this category represent the subjects' attempts to build their understanding of the passages by using background knowledge (p. 281).

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