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Developing a reading comprehension intervention: Translating cognitive theory to educational practice ☆

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ABSTRACT

The purpose of this study was to translate cognitive models of reading comprehension to educational practice to develop an intervention that is theoretically sound, effective, and feasible for classroom use. Specifically, the effects of questioning *type* (Causal versus General) and *timing* (Online versus Offline) on struggling readers' comprehension were compared. Sixty-two fourth-graders identified as struggling comprehenders were placed in groups of 3–5 students; groups were assigned randomly to Causal or General questioning conditions. All groups received both Online and Offline questioning in counterbalanced order. Tutors delivered intervention for 20–30 min, 3 times per week, for 18 sessions. Dependent measures included students' recall and oral reading of narrative text. Theoretical, empirical, and practical perspectives were triangulated to select the combination of question type and timing that appeared most promising. Findings are discussed with particular emphasis on challenges associated with translating cognitive theory to practice in classroom-based settings.

1. Introduction

To be successful in school and later life, students must learn to read and understand a wide range of texts (Chall, 1996; Snow, 2002). Yet, many children who successfully learn to decode text in early elementary grades begin to struggle in later grades when requirements for reading comprehension become increasingly complex (e.g., Chall, Jacobs, & Baldwin, 1990; Sweet & Snow, 2003). For some students, reading comprehension problems are difficult to remediate, and the gap between these students and their peers becomes larger and more difficult to close as time passes (Faggella-Luby & Deshler, 2008). Failure to become proficient in reading can lead to long-term negative outcomes in school and beyond (Snow, 2002).

A large research base points to an array of interventions to address reading comprehension difficulties. Literature syntheses have indicated moderate to large effect sizes supporting these interventions (Berkeley, Scruggs, & Mastropieri, 2010; Gajria, Jitendra, Sood, & Sacks, 2007; Mastropieri & Scruggs, 1997; Sencibaugh, 2007). Yet, many students continue to struggle with reading comprehension despite intervention (e.g., Gersten, Fuchs, Williams, & Baker, 2001; Swanson, Hoskyn, & Lee, 1999). Thus, it is important to understand *for whom* and *under what conditions* such interventions are most effective (Faggella-Luby & Deshler, 2008). Prominent researchers have emphasized the need to strengthen connections between theory and educational practice to attain such an understanding (McKeown, Beck, & Blake, 2009; Pressley, Graham, & Harris, 2006). In this paper, we report results of an ongoing program of research aimed at connecting theory and practice, specifically by using insights from cognitive science to develop interventions that meet the needs of children who struggle with reading comprehension.

1.1. Using cognitive science to inform reading intervention development

Central to cognitive theories of reading comprehension is the notion that successful comprehension depends on the construction of a coherent representation of text in memory (Kintsch, 1998; McNamara & Magliano, 2009). This coherent representation contains important information in the text, is integrated with the reader's background knowledge, and can be easily accessed and applied in a variety of situations (e.g., Goldman & Varnhagen,

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1986; Oakhill & Cain, 2012; Trabasso, Secco, & van den Broek, 1984). During reading, a combination of automatic and strategic processes takes place by which a reader makes connections among important parts of the text. These connections help to build structure and coherence.

Goldman and Duran (1988) described a continuum of comprehension tasks that vary in the degree to which the tasks require text-based or background knowledge to support a coherent representation of text. On one end of the continuum, comprehension tasks are highly text-dependent, requiring a literal understanding of the text; on the other end, comprehension tasks are text independent, requiring background knowledge beyond the text. Most comprehension tasks required of school-aged readers fall somewhere in between, requiring both text-based and background knowledge to make meaningful connections between sentences in text.

Readers may struggle to comprehend text for different reasons: they may not have (or efficiently access) relevant background knowledge, may not make connections among relevant text-based information, or may not integrate background knowledge with text-based information to draw inferences needed to construct a coherent representation (Cain & Oakhill, 2007; van den Broek & Espin, 2012a). One way to guide readers toward a coherent representation of text is to ask questions that help them identify connections between important parts of the text. Cognitive science may help illuminate how questioning may be used to support such connections. In the current study, we focus on *type* and *timing* of questioning, as described below.

1.1.1. Type of questions

The effectiveness of questioning approaches may vary depending on how questions are constructed. Cognitive models of reading comprehension may provide guidance about which *types* of questions improve coherence. For example, to make meaningful connections between parts of the text, readers must identify the causal and logical relations among events in the text (Trabasso et al., 1984). Researchers have found causal relations—those that enable readers to identify how different events or facts lead to or depend on each other—to be particularly important for establishing coherence (e.g., Graesser & Clark, 1985; Trabasso & van den Broek, 1985). The following simple example illustrates the importance of identifying causal relations: "John dropped a banana peel. Joanne fell on her back." To establish causal coherence, the reader must infer that Joanne slipped on the banana peel that John dropped. This inference requires text-based knowledge (Joanne could have fallen for a variety of reasons, but because the text says that John dropped a banana peel, one can infer that this action caused her fall). The inference also requires background knowledge (banana peels are notoriously slippery, and Joanne likely stepped on it and slipped).

In a complete text, the causal relations that readers must infer are usually more complex, extend over longer distances, and may require coordination of multiple pieces of text-based information and background knowledge (van den Broek, 2012). Asking questions that direct the reader's attention to important causal relations may support the complex cognitive task of constructing a coherent representation of the text. In the example above, a causal question might be, "Why did Joanne fall?" Based on the cognitive models outlined above, the benefit of a causal questioning approach is that it should direct the reader to connect important text elements, and thus support construction of a coherent representation of the text.

On its face, translating a theoretically-sound, causal questioning approach to classroom-based intervention may seem straightforward. Yet, developing causal questions can be labor intensive, because it requires aligning questions with the causal structure of text and appropriately placing them to direct the reader's attention to information most relevant to establishing coherence. Thus, this approach may not always be easily applied to texts used in classroom settings. A more practical approach may be to ask a general question designed to prompt the reader to connect information in the text (e.g., McKeown et al., 2009). An example of a general question is, "How does this sentence connect to something you learned earlier in the text?" Practically speaking, teachers can apply the same general question across a variety of texts. However, general questions may not necessarily prompt connections among the most *relevant* text elements and thus may not contribute to a coherent representation. The above theoretical and practical considerations raise the question as to whether asking specific causal questions support struggling readers' construction of coherent text representations, and whether more general questions (which may be more practically feasible) can achieve the same result.

1.1.2. Timing of questions

In addition to the type of questions, the timing of questioning may affect students' construction of a coherent representation of text. According to cognitive models, a coherent representation of text is a *product* of reading comprehension, but the actual construction of that representation of text is a *process* that occurs during reading (Kintsch, 1998). Thus, an important consideration for intervention is whether it is more beneficial to ask questions during reading (i.e., *online*), or after reading (i.e., *offline*).

The rationale for *online* questioning is that interventions should focus on the cognitive processes that operate during reading, as it is during these moment-by-moment processes that comprehension succeeds or fails (e.g., Kintsch, 1998; van den Broek, Helder, & Van Leijenhorst, 2013). According to the Landscape Model (e.g., Van den Broek, Young, Tzeng, & Linderholm, 1999), proficient readers engage in complex, dynamic allocation of attention as they proceed through a text; with each new text segment, incoming text information receives attention, information from the preceding text segment is selectively retained or de-activated, and background knowledge is activated (e.g., Fletcher & Bloom, 1988; Kintsch, 1988). These shifts in attention result in a landscape of fluctuating activations, allowing the reader to identify meaningful connections within the text, and between text and background knowledge (e.g., Goldman & Varma, 1995; van den Broek et al., 1999). Online questioning may help prompt such connections.

The rationale for *offline* questioning is that, as readers construct a coherent representation of text, they must work within the inherent limitations of attention and working memory (Just & Carpenter, 1992). Interrupting the reading process with questions may compete with cognitive processes needed to maintain coherence, especially for struggling readers (Goldman, 2004). For example, van den Broek, Tzeng, Risden, Trabasso, & Basche (2001) found that online questioning helped older children construct mental representations of text but interfered with young children's ability to do so. Thus, offline questioning may be more effective than online questioning for struggling readers because offline questions would help them to identify critical causal relations in text without overly taxing attention and working memory.

1.2. The effects of type and timing of questions on reading comprehension

The goal of our research is to test these cognitive and educational considerations concerning the type and timing of questions. In earlier work (van den Broek, McMaster, Rapp, Kendeou, Espin, Deno, 2006), we compared causal and general questioning in brief, one-on-one intervention sessions with fourth graders ($n = 78$), and found that causal questioning led to more complete recalls of text than did general questioning ($d = .53$). We used this information to develop extended classroom-based questioning interventions, and conducted a randomized field trial (McMaster et al., 2012), in