Children's Text Comprehension: Effects of Genre, Knowledge, and Text Cohesion

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Abstract. Our goal in this project is to develop a better understanding of text comprehension exhibited by elementary-school children. The research focused on the role of text genre (narrative and expository text), text cohesion (high or low) and the readers' level of prior world knowledge (assessed using the Woodcock–Johnson III Academic Knowledge test). Sixty-four students in the fourth grade read four texts, including one high-cohesion and one low-cohesion text from each genre. Comprehension of each text was assessed with 12 multiple-choice questions, including both local questions (focusing on specific information contained in one or two sentences) and global questions (focusing on general themes). Children showed better comprehension of the narrative than expository texts, but this advantage appeared only on global questions. There was a benefit of higher knowledge, but only for the expository texts. The benefits of cohesion were greatest for narrative text comprehension and on global questions.

Introduction

Comprehending and learning from written material is of paramount importance to academic success. Whereas children's reading competency develops throughout the school years, a critical period in reading development seems to occur between the third and fifth grades. An emergence of comprehension difficulties around the middle of this period is sometimes referred to as the *fourth-grade slump* (Meichenbaum & Biemiller, 1998; Sweet & Snow, 2003). Our study explored children's reading comprehension in this critical period, during the fourth grade. We explored the sources of the children's comprehension difficulties by focusing on the roles that text genre (narrative story or expository/informational text), text cohesion (high or low), and the reader's level of knowledge (high or low) play in the children's reading comprehension processes.

Sources of comprehension difficulty

Reading comprehension can be defined as "the ability to obtain meaning for some purpose" (Vellutino, 2003, p. 51). In order to comprehend successfully, the reader must identify a series of letters as a word, access the meaning of the word from the lexicon or mental dictionary, and integrate individual word meanings into a coherent sentence level representation. As such, successful reading comprehension requires the efficient coordination and integration of a number of underlying cognitive processes, which include reading decoding abilities and the utilization of linguistics and relevant previous knowledge (Kintsch, 1988, 1998; Perfetti, 1985).

Topic-relevant or world knowledge plays a critical role in successful comprehension of texts, as readers must use their knowledge to integrate meanings of individual sentence meanings into a coherent representation of situations or events depicted by overall text, which is often called the situation model (Kintsch, 1988, 1998). Thus, the situation model refers to the integration of the textbase and the reader's prior knowledge. Whether the reader can develop a global, deep-level comprehension of the overall text meaning is also likely to be affected by text genre (e.g., narrative vs. expository). Narrative texts usually present reoccurring topics (e.g., friendship, love, parting with a friend) in a specific context involving particular characters, settings, and times. Readers often have extensive first-hand experience and knowledge (i.e., schemas) regarding the events and situations described in typical narrative texts. On the other hand, expository texts (e.g., science texts) present specific scientific or historical facts, relations between facts, or both to provide the reader with information about concepts and events. Importantly, readers are likely to be unfamiliar with much of the text's subject matter because (a) they lack knowledge of situations described by this type of text, and (b) typical descriptions used in this type of text (e.g., conductance of heat) often involve abstractions of first-hand experience. Of course, some expository texts may describe familiar information in more concrete ways, but these are rather exceptional cases (see Beck, McKeown, & Gromoll, 1989). In general, whereas readers may easily draw on background knowledge to comprehend

narrative texts, they may struggle to develop situation model representations of expository texts as they lack necessary background knowledge.

As indicated above, some elementary school children begin to experience notable difficulty comprehending texts around the fourth grade (Snow, 2002). One possible interpretation for this educational phenomenon is that reading difficulty is related to the introduction of expository texts during the third and fourth grades. Whereas early elementary school reading instruction focuses on development of fundamental reading skills (i.e., learning to read), reading goals shift toward reading to learn in the third and fourth grades. As this transition occurs, students are increasingly exposed to texts comprising unfamiliar content and are expected to comprehend and learn something new from these texts. In reading situations where children are required to individually read these expository texts, without help from the teacher, they may struggle to comprehend the contents.

Although children generally read expository texts to acquire new information, research indicates that expository texts read by fourth grade students are not written in an ideal manner to support learning and comprehension among novice readers' with limited background knowledge. Beck et al. (1989) performed an extensive analysis of four elementary school social studies texts and found that the texts comprised unclear goals and poor explanatory links and assumed too much knowledge on the part of readers. These limitations relate to what is generally called text coherence or cohesion (e.g., McNamara, Kintsch, Songer, & Kintsch, 1996). A low-cohesion text with poor explanatory links places increased demands on the reader's ability to form a global, coherent understanding of text and integrate information in the text based on prior knowledge. Texts are considered to be low-cohesion when constructing a coherent representation from the text requires many inferences. Texts are considered high-cohesion when elements within the text provide more explicit clues to relations within and across sentences.

Overall, comprehension difficulties encountered by fourth graders are in part likely to be related to both knowledge deficits and the level of text cohesion in which children's texts are typically written. The Construction-Integration model (Kintsch, 1988, 1998) of text comprehension suggests that comprehension can be improved when text cohesion is increased, thus reducing the need to make inferences. This improvement would be particularly evident for readers who are unable to generate inferences themselves due to a lack of prior knowledge. Thus, increased text cohesion should have a positive effect on children's text comprehension, particularly expository text for which they lack background knowledge (e.g., McNamara et al, 1996).

Present study

The present study examined fourth grade children's comprehension of narrative and expository texts used in the classroom. We evaluated comprehension as a function of text genre, text cohesion, and the readers' level of world knowledge. We expected that comprehension of expository texts would be increased for readers with higher knowledge and for texts that were classified as high-cohesion. Finally, we expected that high-cohesion texts would be more likely to facilitate comprehension than low-cohesion texts.

Method

Participants included 64 children enrolled in the fourth grade at four public schools in a large metropolitan school district. Children ranged in age from 9 years, 2 months to 11 years, 2 months (M = 118.20 months, SD = 5.34 months). Girls represented 52.3% of the sample (n = 33), and boys represented 47.7% of the sample (n = 31). Approximately 40% of the children were African American (n = 26), 53% were Caucasian (n = 35), and 6% were Asian-Pacific Islanders (n = 3).

Design and Materials

The study used a within-subjects design in which children read four passages, including two expository and two narrative texts taken from school textbooks. The expository texts were *Heat* and the *Needs of Plants*; the narrative texts were *Moving* and *Orlando*. Each of the two texts within each genre included one low-cohesion version and one high-cohesion version (see Table 1). The low-cohesion version was the original version of the text, whereas the high-cohesion version was modified to have greater cohesion (e.g., causal connectives and explanatory links between concepts and ideas). Table 1 presents some of the main text characteristics for the eight texts (see cohmetrix.memphis.edu for more information about the measures). The argument overlap scores, which relate to the proportion of adjacent sentences that share one or more arguments (e.g., pronoun, noun or noun phrase), were higher for the high-cohesion versions of the texts. Incorporating words and phrases to increase cohesion has an effect on text length, such that the high-cohesion versions of the texts comprised more words than the low-cohesion versions. In

addition, manipulating texts for cohesion affected the grade level scores, such that the high-cohesion versions received higher grade-level scores than low-cohesion versions. Grade level assignments are primarily based on factors such as the number of words in the sentences and the number of letters or syllables per word (i.e., as a reflection of word frequency). Thus, adding words and sentence length increases grade level scores.

Table 1. Select Characteristics of the Narrative and Expository Texts

Text	Genre	Cohesion	Argument overlap	Number Words	Grade Level
Heat	Expository	Low	0.64	401	2.8
		High	0.81	518	4.9
Needs of Plants	Expository	Low	0.75	466	3.8
		High	0.81	634	3.7
Moving	Narrative	Low	0.39	437	4.0
		High	0.76	584	4.8
Orlando	Narrative	Low	0.33	446	2.3
		High	0.59	541	3.9

Multiple-Choice Questions

Twelve multiple-choice questions were constructed for each text to assess students' comprehension. Six of the questions were designed to tap local-level comprehension, and the other six were designed to tap global-level comprehension. Whereas local questions tapped specific information that was within five or fewer clauses (mostly within 2 sentences), global questions drew upon information located across six or more clauses - ideas that needed to be connected by the reader to construct a deeper, more global understanding of the text (Kintsch, 1993). Each multiple-choice question had four answer options with only one being the correct answer. Examiners read the questions orally while the questions were presented in text form. The children were required to vocalize the correct answer. Comprehension scores for each text were obtained for each child by calculating the proportion of correct responses to total questions (i.e., 12).

Aptitude Measures

The Academic Knowledge test from the Woodcock–Johnson III Tests (WJ III) of Achievement (Woodcock, McGrew, & Mather, 2001) was used as the measure of prior knowledge. The test assesses knowledge about the biological, physical, and social sciences and the humanities. Scores from each domain were summed to produce test raw scores, and age-based standard scores (M = 100, SD = 15) were obtained. The Academic Knowledge test has a median internal consistency reliability coefficient of .84 for ages 9 to 11 (McGrew & Woodcock, 2001).

Procedure

Recruitment of children consisted of sending letters of invitation to parents of fourth-grade children through the children's school classrooms. The letters provided information about the study and requested that parents contact the researchers to schedule a testing session. Testing sessions took place on Saturdays. Children were tested individually by examiners who had successfully completed graduate training on the administration of standardized test batteries. Children first silently read one of the four texts in a 5-minute period. After reading the first text, the text was removed from view before answering the 12 multiple-choice questions relating to the text. This process was repeated with the three remaining texts. The cohesion manipulation was organized such that children read either the low-cohesion or high-cohesion version of each text. The cohesion manipulation was counterbalanced, such that an equal number of children read high- and low-cohesion versions of each of the four texts. Also, the order of text presentation was counterbalanced such that half of the children read a narrative text first (either Orlando or moving), and half read an expositive text first (either plants or heat). After reading the texts and answering multiple-choice questions, children completed the aptitude measures. The session lasted approximately two hours. After completion of the testing, children were provided with a $20 gift card to a department store, coupons from merchants, and school supplies.

Results

The analysis involved a 2 (narrative vs. expository) x 2 (low vs. high-cohesion) x 2 (local vs. global questions) x 2 (high vs. low knowledge) mixed analysis of variance (ANOVA) on the proportion

correct scores from the multiple-choice questions. The between-subjects variable (low vs. high knowledge group) was formed by grouping all children who obtained a score below the median in the *low* group and all children who obtained scores at or above the median in the *high* group. For all effects reported below, alpha was significant at the .05 level unless otherwise noted.

Genre and question type

As expected, there was a main effect of genre, $F(1,63) = 75.00$, $p < .001$, $MSE = 1.64$, indicating that children's comprehension was better for the narrative texts ($M = 72$, $SD = .12$) than for the expository texts ($M = .56$, $SD = .19$). Children also performed better on the local questions ($M = .67$, $SD = .14$) than the global questions ($M = .62$, $SD = .16$), $F(1,63) = 4.38$, $MSE = 1.13$. There was an interaction between genre and question type, $F(1,63)= 3.83$, $MSE = 1.82$, $p = .055$, which indicated that children's performance on global questions was better for the narrative texts ($M = .76$, $SD = .14$) than the expository texts ($M = .48$, $SD = .23$), $t(64)= 10.80$. However, performance on local questions did not differ between the narrative texts ($M = .68$, $SD = .18$) and the expository texts ($M = .65$, $SD = .20$). Thus, the locus of the genre effect was on global questions.

World knowledge

There was a main effect of knowledge, $F(1,63)= 63.03$, $MSE = 2.91$, indicating that children with high levels of knowledge comprehended the texts ($M = .74$, $SD = .09$) better than children with low levels of knowledge ($M = .54$, $SD = .10$). Furthermore, there was a significant interaction between knowledge and genre, $F(1,63)= 13.29$, $MSE = 1.64$. That is, high-knowledge students' comprehension advantage was larger for expository texts ($M_{high} = .69$, $SD_{high} = .09$; $M_{low} = .42$, $SD_{low} = .14$), $t(63) = 7.35$, than for narrative texts ($M_{high} = .79$, $SD_{high} = .08$; $M_{low} = .65$, $SD_{low} = .11$), $t(63) = 5.20$.

Text cohesion

There was a main effect of text cohesion, $F(1,63) = 12.42$, $MSE = .92$, indicating that children comprehended the high-cohesion texts ($M = .68$, $SD = .15$) better than the low-cohesion texts ($M = .63$, $SD = .15$). As indicated in Table 2, there was also a significant interaction between cohesion and genre, $F(1,63)= 76.10$, $MSE = .97$. Children comprehended the high-cohesion narrative text better than the low-cohesion narrative text, $t(63) = 2.89$, but there was no difference in comprehension of the expository texts as a function of text cohesion, $t(63) < 1.0$.

Table 2. Proportion correct scores on the narrative and expository questions as a function of text cohesion

Text	Narrative *M* (*SD*)	Expository *M* (*SD*)	Total *M* (*SD*)
High Cohesion	.75 (.12)	.56 (.22)	.68 (.15)
Low Cohesion	.69 (.16)	.57 (.20)	.63 (.15)

Finally, there was an interaction, approaching statistical significance, between text cohesion and question type, $F(1,63) = 3.83$, $MSE = 1.12$, $p = 0.51$. A follow-up analysis indicated that children performed better on the global questions after reading the high-cohesion texts ($M = .65$, $SD = .18$) than the low-cohesion texts ($M = .59$, $SD = .18$), $t(63) = 2.92$. However, there was no difference in children's performance on the local questions after reading high-cohesion texts ($M = .67$, $SD = .17$) and low-cohesion texts ($M = .67$, $SD = .16$). There were no other statistically significant interactions involving text cohesion.

Discussion

The research was designed to further the understanding of the nature of reading comprehension difficulties among children in the fourth grade. To this end, we evaluated the role of genre, text cohesion, and knowledge, which are known to play a critical role in the comprehension process. The findings are, overall, consistent with results from previous research, but some findings offered a greater insight into the nature of reading comprehension difficulties. In line with previous research, children were more likely to encounter difficulty comprehending the expository texts than the narrative texts for which text contents is more likely to be familiar (e.g., Olson, 1985). Further, for expository texts, children were more likely to encounter difficulty answering the global questions that require more extensive integration of the textual information than local questions, which focus on an idea located in specific part of the text.

One reason for children's difficulty regarding the comprehension of expository texts concerns a lack of knowledge needed to process contents of expository texts (Snow, 2002). Our findings support this notion; children with higher levels of knowledge were more likely to comprehend texts better, and the benefit of the higher knowledge was larger for expository texts.

Regarding new insights, our findings indicate that comprehension was associated with text cohesion, such that high-cohesion texts were more likely to facilitate comprehension than low-cohesion texts. Importantly, contrary to our expectation, this experiment showed that the benefit of cohesion was specific to narrative texts. No benefit of cohesion was observed for expository texts where increased cohesion was originally expected to help students overcome knowledge deficits. It may be that increased text cohesion optimizes comprehension only when the reader has a certain level of understanding for the text contents. For young children with little exposure to expository texts, levels of knowledge relating to content materials may be too low (i.e., children do not understand many of the words), and thus, the degree to which cohesion was increased in this study may not have been sufficient to facilitate understating of unfamiliar expository texts. Instead, increased cohesion helped readers understand more familiar narrative texts. This finding indicates that students at this age are still struggling with the inferential processes required for understanding narrative texts. The benefits of the added cohesion indicate that relieving those demands can improve comprehension for some readers.

In terms of the wider educational implications for reading comprehension and facilitating learning from reading school-based materials, our findings suggest that one option is to modify texts, by adding cohesion cues (e.g., identifying anaphoric referents, synonymous terms, connective ties, and headers) and supplying background information that was previously left unstated in the text. Another alternative is to analyze text features that are relevant to text comprehension to assign appropriate texts to students according to their ability level. Currently, however, readers, writers, editors, educators, researchers, and policy makers can only estimate the appropriateness of a text using common readability formulas, such as Flesch Reading Ease and the Flesch–Kincaid Grade Level, which are based primarily on factors such as the number of words in the sentences and the number of letters or syllables per word (i.e., as a reflection of word frequency).

It is for that reason that McNamara and colleagues are developing an automated tool, called Coh-Metrix, which provides measures of text cohesion and text difficulty (Graesser, McNamara, Louwerse, & Cai, 2004). Coh-Metrix (version 1.0) automatically analyzes texts on over 50 types of cohesion relations and over 200 measures of language and discourse by applying modules that use lexicons, classifiers, syntactic parsers, shallow semantic interpreters, conceptual templates, latent semantic analysis, and other components widely used in computational linguistics. The ultimate goal is to have a tool that augments standard readability formulas. This tool will allow publishing houses, educators, and researchers to measure the difficulty of a particular text within a particular text genre tailored at particular reader groups (see http://coh-metrix.memphis.edu). A better understanding of the effects of cohesion on readers' comprehension will provide valuable insight and explicit direction on how to improve texts while taking into consideration the target readers' aptitudes.

In conclusion, our research has offered an insight into reading comprehension difficulties encountered by children in the fourth grade. While prior knowledge and text cohesion go some length in explaining children's difficulties in comprehending texts, we acknowledge that comprehension success depends on a wide range of variables (Snow, 2002). Certainly, educational literature has indicated that the contexts of learning, such as the ways in which textbooks anchor information to children's prior experiences and interactions between children and teachers during the time of reading, play critical roles in facilitating comprehension (e.g., Moje, 1996). Thus, a fully comprehensive account of textbook understanding ought to consider the contexts in which books are read, and more specifically, ways in which reading is supported by class activities such as hands-on experiences (Glenberg, Gutierrez, Levin, Japuntich, & Kaschak, 2004; Guthrie, 2003) and practice questions (van den Broek, Tzen, Risden, Trabasso, & Basche, 2001).

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