

Text Availability and Reading Comprehension Assessment

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Abstract. Reading tests differ in whether they allow students to refer back to the text during question answering. It has been claimed that with-text questions are confounded by students' motivation to engage in strategic reprocessing while without-text questions measure students' online comprehension. In the present study, I investigated the online reading behaviour of 15-year old students while they read the texts of a comprehension test and answered both with- and without-text reading comprehension items. Students' resource allocation to several cognitive processes on the word-, sentence-, and text-level was measured by decomposing their word-by-word reading times using mixed-model analysis. In addition, students' lexical access speed, vocabulary knowledge, working memory capacity, and verbal problem solving skills were assessed. Results show that verbal background variables had similar effects on students' comprehension performance in both conditions. In contrast, indices of students' online processing were more strongly related to their test performance in the without-text condition.

Keywords: Text Comprehension; Reading Assessment; Text Availability; Reading Time Components

Theoretical Background

In most reading comprehension tests, students read short texts and have to answer comprehension questions afterwards. However, in some tests students are able to access the text during question answering (with-text administration) while in other tests, they are not allowed to refer back to the text (without-text administration). Proponents of the with-text approach have stressed that having the text available during question answering is more ecologically valid. Moreover, if students are unable to refer back to the text during question answering, students' comprehension and memory skills are confounded (Artelt, Schiefele, & Schneider, 2001). In contrast, proponents of the without-text approach have argued that a without-text presentation is a purer measure of students' online comprehension because test performance relies less on students' motivation to reanalyze the text during question answering (Ouzuru, Best, Bell, Witherspoon, & McNamara, 2007). Instead, in this condition, students' test performance is driven by their ability to establish a coherent situation model using automatized comprehension processes such as knowledge activation and inferencing.

There has been very little empirical research on how text availability influences test performance. The available empirical evidence, however, seems to support the hypothesis that without-text comprehension items measure online-comprehension processes while with-text comprehension items measure readers' ability to engage in extensive strategic reprocessing (Artelt et al., 2001; Johnston, 1984; Ozuru et al., 2007). However, all these studies relied exclusively on differential correlations of students' test performance in the two text availability conditions with offline measures such as students' prior knowledge or inferencing skills. Thus, from a methodological point of view, they are unable to exclude the possibility that these differential effects are merely generated during question answering. To ensure that test performance on without-text items is really more sensitive to students' online-comprehension, one needs online measures of the cognitive processes performed during reading the texts. In the present study, I assessed students' resource allocation to cognitive processes on the word-, sentence-, and text-level by decomposing their reading times into reading time components using mixed-model analyses (Stine-Morrow, Miller, & Hertzog, 2006). Thus, I was able to test whether students' test performance in the with- or without-text condition is differentially related to indices of their online-comprehension: If students' test performance in the without-text condition is indeed more sensitive to their online-comprehension skills, comprehension in the without-text

condition should be more strongly related to students' reading time components than in the with-text condition.

Methods

The final sample consisted of 119 high-school students from the 8th and 9th grade. In a first session, students' verbal abilities (lexical access speed, vocabulary knowledge, working memory capacity, and verbal problem solving skills) were assessed. In a second session, students worked on eight texts of a standardized reading comprehension test in two different conditions that differed in the question answering phase: In the with-text condition, students answered the comprehension items while the text was completely visible. In the without-text condition, in contrast, students only received the items and were not able to see the text. All texts were read in a moving window paradigm which allows collecting word-by-word reading times as an online measure of students' text reading. Word reading times were regressed in a mixed-model analysis on a set of linguistic variables in order to decompose students' text processing into separate reading time components for three different aspects of text processing: word-level processes (orthographic decoding and lexical access), conceptual integration, and updating (Haberlandt & Graesser, 1985). Estimates for the individual effects of each student were used as indices of their resource allocation for the different component processes.

Results

Dimensionality

In a first step, I tested whether students' performance in the with- and without-text condition measure a single latent ability or is driven by two different latent abilities. To this end, items were scaled with either a one- or a two-dimensional IRT-model. In the one-dimensional model, items from both text availability conditions were assumed to load on a single latent variable. In contrast, in the two-dimensional model, items from the with- and without-text condition were assumed to load on two different latent variables. Although the latent correlation between the two dimensions was very high ($r = .93$), a likelihood ratio test comparing the fit of the one- and two-dimensional model indicated that the two-dimensional model fitted the data significantly better ($\Delta\chi^2(2) = 8.9, p < .05$).

Effects of students' verbal abilities and reading time components on test performance

Next, I examined the effects of students' verbal abilities and reading time components on comprehension using multiple regression analyses. The results of this analysis are given in Table 1. Together, verbal abilities and reading time components were able to explain 48% of students' comprehension variance in the with- and 55% in the without-text condition. For the ability effects, lexical access speed, vocabulary knowledge, and verbal intelligence influenced students' test performance in both experimental conditions. There was a slight trend that vocabulary knowledge was a better predictor of students' test performance in the with-text condition while verbal intelligence was a better predictor of students' performance in the without-text condition. For the effects of students' reading time components, there were large differences between the two conditions. In the with-text condition, there was only a small effect of students' orthographical processing on test performance. In the without-text condition, in contrast, both students' amount of conceptual processing and of their within-sentence updating was positively related to their test performance. Likelihood ratio tests confirmed that both effects were significantly higher in the without- than in the with-text condition.

Table 1: Effects of students' verbal abilities and reading time components on their test performance.

Variable	With Text			Without Text			$\chi^2 (1)$
	β	SE	$t(109)$	β	SE	$t(109)$	
Verbal Abilities							
Lexical Access	.26	.08	3.12**	.27	.08	3.46**	0.02
Vocabulary Knowledge	.28	.08	3.58**	.19	.07	2.61*	1.57
Working Memory	.10	.08	1.24	.12	.08	1.57	0.08
Verbal Intelligence	.22	.08	2.90**	.28	.07	3.87**	0.69
Reading Time Components							
Orthographical Processing	.18	.08	2.23*	.07	.07	0.93	2.44
Lexical Access	.07	.08	0.92	.08	.07	1.07	0.01
Conceptual Integration	-.01	.08	0.13	.15	.07	2.07*	5.66*
Within-Sentence Updating	.06	.08	0.71	.19	.07	2.57*	3.82 ⁺
Between-Sentence Updating	.03	.07	0.35	-.03	.07	-0.50	0.89

Discussion

Overall, there were both similarities and differences between the two text availability conditions. On the one hand, test performance in both text availability conditions was highly intercorrelated and the pattern of effects of students' verbal abilities on their test performance did not differ between the two test conditions. This indicates that the cognitive processes needed for question answering were generally similar in the two conditions. On the other hand, test performance in the without-text condition was more strongly related to the quality of students' reading processes during text encoding. Crucially, these differential effects were only observed for reading time components associated with students' high-level conceptual processing and situation model construction. This supports the hypothesis of Ozuru et al. (2007) and Artelt et al. (2001) that performance on without-text items are a purer measures of students' online comprehension during text reading.

References

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