

Summary

Examining the Sentence Comprehension Skills of Students with and without Reading Difficulties

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Reading is the process of extracting and constructing meaning from text (Gough & Tunmer, 1986; Tunmer, 2008). The ability to read is assumed to rely on two processes: (a) a word recognition process, and (b) a comprehension process. The word recognition process is implemented as a cognitive procedure that converts graphemes into corresponding phonemes whereas the comprehension process is implemented as a process that integrates the meaning of recognized printed words into a meaningful whole. Thus, in order to become a proficient reader, one first has to be able to recognize words correctly and rapidly and in a second step has to grasp their final meaning within the context of a sentence (Bradley & Bryant, 1983; Caravolas, Hulme, & Snowling, 2001; Gough & Tunmer, 1986; Høien, Lundberg, Stanovich, & Bjaalid, 1995; Torgesen, Wagner, & Rashotte, 1997; Tunmer, 2008).

In general, researchers hypothesize that two potential factors cause difficulties in the retrieval of meaning from written text: (a) various shortcomings in the reader's spoken language; and (b) deficiencies in the processes by means of which print is connected to the reader's spoken language (Catts & Kamhi, 2005; Faust & Kandelshine-Waldman, 2011; Gough & Tunmer, 1986; Nation, 2005; Tunmer, 2008; Tunmer & Greaney, 2010). Given this to be true, reading problems may originate from deficits at the spoken language level (e.g., oral language comprehension, receptive and expressive vocabulary knowledge, morphological and syntactic processing), from a processing failure at the word decoding level, or both.

According to Simple View of Reading (SRV, Figure 1), a model provides a framework for conceptualizing three broad categories of reading difficulties, readers can be classified into three groups based on their weaknesses in recognizing printed words, weaknesses in comprehending spoken language, or both (Catts & Kamhi, 2005; Faust et al., 2011; Gough & Tunmer, 1986; Nation, 2005; Tunmer, 2008; Tunmer & Greaney, 2010).

Due to this model, students who can understand a text when it is read aloud to them but cannot decode the words even after receiving extensive instruction are referred to as dyslexics (Gough & Tunmer, 1986; Tunmer, 2008); students who can read words accurately but have difficulty constructing the meaning of text are described as having specific reading comprehension difficulties (Nation, 2005); and students who have problems in both word recognition and oral language comprehension are described as having a mixed reading disability (Catts & Kamhi, 2005).

Several explanations have been proposed as to why readers have difficulty making sense of written text. One such explanation claims that reading comprehension failure in poor readers reflects a processing deficit at the lexical (word) level. Researchers who have studied factors associated with reading comprehension failure of students with reading difficulties tend to agree that the reading comprehension process goes from lexical level (word processing) to sentence level (sentence comprehension). This fact notwithstanding, it can be seen that researchers generally concentrated on phonological or

Word Recognition	Good	Specific Reading Comprehension Difficulties	Normally Developing Readers
	Poor	Mixed Reading Disability	Reading Disability (Dyslexia)
		Poor	Good
		Oral Language Comprehension	

Figure 1. Classification of Different Categories of Reading Difficulty According to SRV

word decoding skills in order to explain the reading difficulties of poor readers (Caravolas, Volin, & Hulme, 2005; Fuchs, Fuchs, Hospue, & Jenkins, 2001; Georgiou & Hayward, 2009; Johnston & Kirby, 2006; Katzir et al., 2006; Kirby, Parrila, & Preiffer, 2003; Manis, Doi, & Bhadha, 2000; Nation & Snowling, 2004; Parrila, Kirby, & McQuarrie, 2004; Savage & Frederickson, 2005; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Shaywitz & Shaywitz, 2005; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997; Vellutino, Fletcher, Snowling, & Scanlon, 2004; Ziegler & Goswami, 2005). Although it is not a sufficient condition for the proper development of reading comprehension, adequate word decoding skills are undoubtedly the basic requirement underlying reading proficiency (Dreyer & Katz, 1992; Fuchs et al., 2001; Gough, Hoover, & Peterson, 1996; Hoover & Gough, 1990; Johnston & Kirby, 2006; Kargin et al., 2011; Katzir et al., 2006; Miller, Kargin, & Güldenoğlu, 2012; Miller, 2004a; 2004b; 2005b; 2006a; 2006b; Savage, 2006; Savage & Frederickson, 2005; Schwanenflugel et al., 2006; Therrien, 2004; Torgesen et al., 1997).

A second explanation attributes the poor reading comprehension skills of readers with reading difficulties to a structural (syntactic) knowledge deficit (Hoeks, Stowe, & Doedens, 2004; Güldenoğlu, Kargin, & Miller, 2012; Miller, 2000; 2005a; 2006b; 2010; Miller, Kargin, & Güldenoğlu, 2013; Morris, 1994; Swinney, Love, Walenski, & Smith, 2007; Tily, Fedorenko, & Gibson, 2010; Weber & Crocker, 2012). In a more recent line of well-controlled experiments, Miller (2000; 2005a; 2006b; 2010) tested the validity of the structural deficit hypothesis with a research paradigm that asked skilled and non-skilled readers to read semantically plausible, semantically neutral and semantically implausible sentences that were structurally identical. Findings pointed that poor readers tend to skip the syntactic structure of the sentence as they read. Instead, to process sentences, they rely upon a top-down strategy that generates sentence meaning by linking content words to their prior knowledge and life experiences (Miller, 2000; 2005a; 2006b; 2010). Whereas such a strategy may prove fairly successful for the comprehension of text for which the reader has substantial prior knowledge, its effectiveness for the comprehension of text that conveys information not reflected in his/her world knowledge seems to be seriously restricted. In order to turn reading into a tool for learning, the reader therefore has to be able to process sentences syntactically via their bottom-up processing that references syntactic structure as a vital source of information. According to this understanding, adequate syntactic (structural) knowledge seems to be most predictive factor for efficient reading comprehension performance.

Regrettably, so far studies that focused on the sentence comprehension skills of readers with specific reading difficulties are strikingly absent in Turkey. Attempts to clarify if and at what level their sentence comprehension skills deviate from those of normally developing readers must therefore be considered of great interest. The present study was designed to fill this gap by comparing the sentence comprehension skills of readers with and without reading difficulties from different grade levels.

Aim

The present study was designed to compare the sentence comprehension skills of readers with and without reading difficulties from different grade levels. According to this aim, present study was designed to answer the following research questions and hypothesis;

1. Overall, the sentence comprehension skills of readers with reading difficulties will be significantly below that of their normally developing counterparts.
2. Differences in sentence comprehension skills between readers with and without reading difficulties will decrease in the course of formal education.
3. Overall, participants will show poorer comprehension for syntactically more complex sentences that comprise two relative clauses than for syntactically less complex sentences that comprise only one.
4. Bias originating from increased syntactic complexity (the syntactic complexity effect) will be significantly more prominent in readers with reading difficulties than their normally developing counterparts.
5. Overall, participants will show poorer comprehension in semantically implausible sentences than in semantically plausible sentences.
6. Bias originating from the plausibility effect will be significantly more prominent in readers with reading difficulties than their normally developing counterparts.

Method

Participants

86 students (35 readers with reading difficulties and 51 normally developing readers) evenly and randomly recruited from two levels of education (3rd-4th graders and 6th -7th graders) participated in this study (see Table 1). Only students with no record of particular learning or emotional disorders were included in this study.

Stimuli

In order to compare the sentence comprehension skills of readers, we used a research paradigm comprised of sixteen (16) sentences, half of which (8) conveyed a plausible message and the other half (8) conveying an implausible message. In each semantic plausibility cat-

egory, half of the sentences were syntactically complex and comprised of one relative clause, while the other half were syntactically complex and comprised of two relative clauses. All semantically plausible sentences referred to situations that are part of the normal experience of children in the youngest group tested in the present study. In contrast, all semantically implausible sentences referred to situations that, although not completely impossible, were not likely to be encountered by any of the tested participants. Comprehension of each sentence in the set was tested by a multiple-choice question, with two or three possible answers. All sentences were built from words that were verified to be well-known within the vocabulary of the youngest participants tested.

Results

In order to compare the participant groups' sentence comprehension, ANOVA was conducted, computing reader profile (with and without reading difficulties) and level of education (elementary and junior-high) as two between-subject factors and syntactic complexity (one relative clause, two relative clauses) and semantic plausibility (plausible, implausible) as two within-subject factors. Mean scores of participants' sentence comprehension with reference to semantic plausibility and syntactic complexity are presented in Table 3 and Table 4.

The main effect of reader profile was statistically highly significant, $F_{1,85} = 30.38, p < .01, \eta^2 = .27$, suggesting that skilled readers had better reading comprehension score than readers with specific reading difficulties. The main effect of level of education was statistically significant, $F_{1,85} = 6.75, p < .05, \eta^2 = .07$, indicating that readers came from junior-high level had better reading comprehension score than readers came from elementary level. The interaction between reader profile and level of education was statistically not significant, $F_{1,85} = .00, p > .05, \eta^2 = .00$, implying that this was true for both readers with and without specific reading difficulties.

The semantic plausibility effect was also statistically significant, $F_{1,82} = 12.15, p < .01, \eta^2 = .12$, indicating that, overall, participants understood semantically plausible sentences better than semantically implausible ones. The effect of syntactic complexity was statistically significant, $F_{1,85} = 14.24, p < .01, \eta^2 = .14$, implying overall better understanding for syntactically less complex sentences than for syntactically more complex ones. In addition to significant main effects, the ANOVA also revealed evidence regarding the ways they interacted.

First, the interaction of semantic plausibility x reader profile was not significant, $F_{1,82} = .73, p > .05, \eta^2 = .00$, indicating that the size of the RC discrepancy between plausible and implausible sentences did not

change over the reader profile of the participants. Further, there was no evidence that semantic plausibility interacted with level of education, $F_{1,82} = 2.09, p > .05, \eta^2 = .02$, implying that variance in RC originating from variance in the test sentences' semantic plausibility was uniform for participants from all levels of education.

In contrast, syntactic complexity was found to interact with reader profile, $F_{1,82} = 8.39, p < .01, \eta^2 = .09$, suggesting that, overall, syntactic complexity had a different effect on readers with and without specific reading difficulties. Of note, syntactic complexity did not interact with the participants' level of education, $F_{1,82} = 3.14, p > .05, \eta^2 = .03$, indicating that differences in comprehension originating from syntactic complexity were uniform over all levels of education.

Finally, the significant interaction between the two within-subject factors, $F_{1,82} = 31.31, p < .01, \eta^2 = .27$, suggested that semantic plausibility impacted RC for syntactically complex sentences with one relative clause and for those with two relative clauses in a different way.

Discussion

The present study was designed to compare the sentence comprehension skills of readers with and without reading difficulties from different grade levels. For this purpose, we compared 86 participants evenly and randomly recruited from two levels of education (low = 3rd-4th graders; middle = 6th-7th graders) on a research paradigm manipulating the semantic plausibility and syntactic complexity of sentences to compare the reading comprehension skills at the sentence level.

First of all, we hypothesized that, overall, readers with reading difficulties will manifest poorer sentence comprehension than their normally developing counterparts and the differences in sentence comprehension between readers with and without reading difficulties would decrease in the course of formal education. As expected, analyses revealed a highly significant reader profile main effect indicating that, overall, readers with reading difficulties had less accurate performances than their normally developing counterparts when it comes to making sense of what they read.

Although processing deficits at the lexical level (especially poor phonological and word processing skills) were mentioned to be a significant contributor to reading comprehension failure of readers with reading difficulties (Caravolas et al., 2005; Fuchs et al., 2001; Georgiou & Hayward, 2009; Johnston & Kirby, 2006; Katzir et al., 2006; Kirby et al., 2003; Manis et al., 2000; Nation & Snowling, 2004; Parrila et al., 2004; Savage & Frederickson, 2005; Schatschneider et al., 2004; Shaywitz & Shaywitz, 2005; Torgesen et al., 1997; Vellutino et al., 2004; Ziegler & Goswami, 2005) it seems reason-

able to assume that the primary cause of marked sentence comprehension limitations of them was not a processing breakdown at the lexical level. Given this to be true, the written words used in the test sentences were very basic and verified to be well-known within the vocabulary of the youngest participants tested in the present study. Additionally, although normally developing readers tested in the present study had no limitations in word processing skills their comprehension of the test sentences was far from perfect (11.47 out of 16).

A more plausible explanation may be that the readers with reading difficulties examined in the present study approached the test sentences with underdeveloped syntactic knowledge, a weakness that has been stressed in literature as a central factor for explaining the impoverished sentence comprehension failure of unskilled readers (Bishop & Adams, 1990; Güldenoğlu et al., 2012; Miller, 2000; 2005a; 2006b; 2010; Miller et al., 2013; Tily et al., 2010; Storch & Whitehurst, 2002).

To clarify whether deficits in structural knowledge may be an adequate explanation for the marked differences in the sentence comprehension skills of readers examined in the present study, we tested two specific hypotheses. Firstly, we hypothesized that, overall, participants would exhibit poorer comprehension of sentences comprising two relative clauses than those including only one relative clause and secondly the syntactic complexity effect would be significantly more prominent among readers with reading difficulties than their normally developing counterparts. Both of these hypotheses were supported in this study indicating that increased syntactic complexity, overall, led to a marked decrease in participants' sentence comprehension skills and the syntactic complexity effect was more prominent among readers with reading difficulties. Due to these evidence, first of all, we can say that both of the participants tested

in this study have some limitations in syntactic knowledge to process the syntactic features of the test sentences and as suggested in literature (Güldenoğlu et al., 2012; Miller, 2000; 2005a; 2006b; 2010; Miller et al., 2013; Tily et al., 2010) because of their limited knowledge in syntactic processing they may have skipped the processing of the test sentences' syntactic structure when trying to make sense of what they read.

In order to understand how readers' syntactic processing skills determined their ability to make sense of what they read, we took a closer look at their understanding of semantically plausible versus implausible sentences and the way this interacted with the test sentences' syntactic complexity. Firstly, we hypothesized that, overall, participants would exhibit poorer comprehension of implausible sentences than plausible ones and secondly the plausibility effect would be significantly more prominent among readers with reading difficulties than their normally developing counterparts. Our findings indeed confirmed that readers with specific reading difficulties, as well as their normally developing counterparts, manifested somewhat better understanding of semantically plausible sentences than semantically implausible ones. Taken as a whole, both of the participants tested in the present study seem to have a seriously limited ability to balance for their impaired syntactic processing abilities by strategically taking on prior knowledge and experience.

In summary, based upon findings revealed from this study, a major problem seems to be the ability of readers to acquire adequate syntactic knowledge and/or to apply it effectively to the materials they read. The poor sentence understanding of the participants, overall, and of the participants from the skilled reader group, in particular, is alarming and it's persistency at more advanced levels of schooling and the way it is related to readers' lexical processing skills should be further investigated.