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Syntax comprehension skills of Turkish-speaking students with dyslexia

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Abstract

Given the fact that the role of syntactic awareness skills on the acquisition of reading skills, we can see how important it is for children to acquire such skills and to solve the relevant problems. This study analyzes the syntactic comprehension skills of students diagnosed with dyslexia. A total of 50 students with dyslexia, 25 in fourth grade and 25 in sixth grade, participated in the study. Attention was paid so that students with dyslexia and those with normal development included in the study had a similar word reading performance. A total of 12 simple and complex syntactic comprehension questions were asked to evaluate the syntactic comprehension performances of students. Compared to their peers without dyslexia, students with dyslexia have low syntactic comprehension performance in both simple and complex structures. This difference was discussed in terms of limitations in syntactic knowledge and skills of students with dyslexia, the reading strategy they use, and their morphological knowledge and skills.

Keywords: Syntax, syntactic knowledge, dyslexia, morphology.

1. Introduction

It is now widely accepted that the processing of a written text is a language-based process, which includes not only phonological and orthographic processes but also semantic and syntactic information (Ferstl & Flores d'Arcais, 1999; Perfetti, 1999). This view suggests reading difficulties, primarily phonological processing difficulties, as well as semantic and syntactic processing difficulties. Dyslexia is a reading difficulty that is of neurobiological origin and is associated with language deficiency. Syntactic deficiencies

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in both verbal and written language are explained in studies on dyslexia (Bishop & Snowling, 2004; Leikin & Bouskila, 2004; Lombardino et al., 1997).

In literature, dyslexia is characterized as a general language weakness in which individuals' language deficiencies are affected by language components. For example, Tunmer and Hoover (1992) argue that metacognitive skills such as syntactic awareness influence reading performance. This hypothesis is based on the finding of Tunmer and Hoover (1992) that syntactic awareness in school-age children affects the analysis skills of readers with disabilities and their peers with normal development (Tunmer and Hoover, 1992). Similarly, Leikin and Bouskila (2004) explain that children with dyslexia perform poorer than good readers in a variety of syntactic processing tasks, including sentence correction, grammatical judgment, and word order. The role of syntax comprehension skills in dyslexia are discussed extensively in international literature (Adlof & Catts, 2015; Gottardo, Stanovich & Siegel, 1997; Tunmer & Hoover, 1992; Wiseheart et al., 2009). Our study offers meaningful findings to national literature as there are no studies on the syntactic comprehension skills of individuals with dyslexia in Turkey. Compared to good readers, poor readers with dyslexia differ in a number of syntactic processing tasks (sentence correction, grammatical acceptability, sentence judgment, etc.) (Adlof & Catts, 2015; Gottardo et al., 1997; Nation & Snowling, 2000; Tunmer & Hoover, 1992; Wiseheart et al., 2009). Deficiency in comprehending syntax was observed in various ages in various syntactic tasks (Nation & Snowling, 2000; Wiseheart et al., 2009).

A sample of a study by McArthur et al., (2000) included 110 children with reading difficulties. In this study, more than half of the children in the sample performed at least one standard deviation below the average in comprehending and producing syntax and vocabulary using standardized tests. In another study, Rispens and Been (2007) evaluated and compared sentence comprehension skills of children with normal development, with specific language disorders, and those with reading difficulties. The results showed that children with reading difficulties performed poorer than children with normal development, but higher than children with specific language disorders and problems with sentence comprehension were associated with limited verbal working memory capacity. The study by Robertson and Joanisse (2010) found that children with learning disabilities and children with specific language disorders perform less well than their age-matched peers with normal development in sentence comprehension and that the correlation between the verbal working memory and sentence comprehension performance were meaningful in both groups. To date, the problem with syntactic skills has been studied mostly in English or other European languages. Syntactic structure in different languages can significantly influence sentence comprehension. In this case the characteristics of language will have a significant impact on the performance of readers with dyslexia in comprehending sentences with different syntactic structures. Conversely, if the syntactic structure is universal, it will allow the findings obtained in

one language to be applied to other languages. However, the role of syntax in general, and the role of syntactic complexity in Turkish, especially morphologically, has hardly been studied even in normal readers. So far, there is a study examining the relationship between syntactic skills and dyslexia in Turkish. In only one study, Güldenoğlu et al. (2015) examined sentence comprehension skills of students with and without reading difficulties. 35 students diagnosed with reading difficulties and have poor word reading skills at grades 3 and 4 and 6 and 7 and 51 students with normal development were included in the study. Students were presented with 16 sentences containing situations that they would describe as "meaningful and meaningless (unfamiliar)". By offering a question and answer options for each sentence, students were asked to mark the option they thought was correct. Students with reading difficulties exhibited lower performance in sentence comprehension skills.

Syntax, a component of language, is a system of rules governing the order of words in sentences, sentence order and word relations (Topbaş, 2005). The most distinctive feature of the Turkish syntax is that the main element in word groups and sentences is usually at the end. This feature distinguishes Turkish from many other languages (for example, Indo-European languages and Arabic), while making it similar to some languages whose origin is still discussed today, such as Mongolian, Manchu-Tunguz (Karahan, 2008). Furthermore, although it is accepted that the fundamental syntax in Turkish is subject-object-verb ("*Ali kitabı okudu*" – "Ali read the book."), Turkish also exhibits flexible syntactic characteristics. Here is an example of the diversity of the Turkish syntax (all of the following sentences have the same meaning using a different syntax): a. Ali okula gitti. b. Ali gitti okula. c. Okula Ali gitti. d. Okula gitti Ali. e. Gitti okula Ali. f. Gitti Ali okula. (Aydın, 2008).

Although students have the ability to recognize words in their reading skills, they still may not comprehend a sentence or text. No matter how much vocabulary knowledge improves, it alone may not be enough for high reading performance. Therefore, in the development of reading and comprehension skills, it is necessary to know the syntactic characteristics as well as vocabulary knowledge (Marschark & Spencer, 2006). As a result, syntactic awareness plays an important role in the development of reading and comprehension skills of good readers and those with dyslexia. This awareness includes the ability of good readers and those with dyslexia to comprehend words that are morphologically complex, and to decode the order of words in a sentence, the grammatical structure that regulates sentence order and word relations.

While it is clear that morphological structures are of vital importance for a language like Turkish with transparent orthography and a wide range of morphemes, the studies in this area are insufficient and mostly compare Turkish with other languages such as English with an opaque orthography. Therefore, comparative studies with different languages that do not reflect the same language characteristics are insufficient to

evaluate reading skills in Turkish, which is very rich in morphemes. It is believed that this study is important as it evaluates the syntactic skills of students with dyslexia by taking into consideration the grammatical features of Turkish, rather than comparing it with other languages.

Although students with dyslexia and those with normal development follow similar steps in the process of literacy, when these two groups are compared, it is worth noting that students with dyslexia lag behind their peers with normal development. The resulting situation raises the need for studying the lingual components that affect the judgment of children with dyslexia about grammaticality, whose reading processes are the same, but reading success levels are different from their peers.

The lingual components that affect the judgment of children with dyslexia about grammaticality are phonological, morphological, syntactic, semantic, and pragmatic components. However, the literature mostly focused on the phonological awareness skills of students with dyslexia. It seems that studies on syntactic structures in texts or sentences, that is, the syntactic aspect of language, are more limited. These studies reveal that syntactic awareness is associated with the reading skills of both normal-developing students and those with dyslexia (McArthur et al., 2000; Nation & Snowling, 2000; Rispens & Been, 2007; Robertson & Joanisse; 2010; Wiseheart et al., 2009).

Students with dyslexia need to develop syntactic awareness skills in order to fully understand a text. Currently, the importance of syntactic awareness skills, which are one of the components of language, in acquiring reading skills is newly understood, while in Turkey, there are very few studies. Given the importance of reading, writing and comprehension skills on the acquisition of academic skills, students with dyslexia will inevitably experience academic failures. Given the fact that literacy and comprehension skills are constantly changing and developing and the role of syntactic awareness skills on the acquisition of reading skills, we can see how important it is for children to acquire such skills and to solve the relevant problems. Based on this problem, the purpose of this study was to examine and compare the syntactic comprehension skills of students with and without dyslexia. For this general purpose, the research hypotheses presented below were examined.

Hypothesis 1 In syntactic comprehension scores, students with dyslexia will perform poorer than those with normal development.

Hypothesis 2 As students' grade level increases, their syntactic comprehension scores will also be higher.

2. Method

2.1. Research Model

This is a descriptive study adopting the screening model with the aim of examining by comparing syntactic comprehension skills of students with and without dyslexia at various grades (4th and 6th).

2.2. Research Group

The research group is made up of a total of 100 students, all of which are attending either the fourth or sixth grade in primary school with Turkish as their native language, 50 of them being diagnosed with learning difficulties (dyslexia) due to the learning difficulties they experience reading and the remaining 50 described by their classroom teachers as showing normal development. The criteria for selecting students with normal development was having Turkish as their native language, not having suspicion of any deficiency (mental, visual, auditory, or neurological) or disorder, fluent reading, and not having comprehension-related problems.

Table 1. Anova results on word reading performance of students with and without dyslexia

Variables		**F**	**p**	**η^2**
Student Group		1.11	.29	.01
Grade		.81	.36	.00
Student Group*Grade		2.30	.13	.02
Student Group	**Grade**	**$\bar{x}$**	**SD**	**n**
Learning disability	4th grade	34.96	4.42	25
	6th grade	34.32	6.85	25
	Total	34.64	5.72	50
Normal Development	4th grade	34.48	5.80	25
	6th grade	37.00	2.79	25
	Total	35.74	4.68	50
Total	4th grade	34.72	5.11	50
	6th grade	35.66	5.35	50
	Total	35.19	5.23	100

According to Table 1, there is no statistically significant difference among the word reading scores of student groups (F(1,96)=1.11, p>.05, η2=.01). According to student groups, the total word reading score averages are similar. There was no statistically significant difference in the word reading scores of students according to their grade (*F(1,96)=.81, p>.05*, η^2=.00). Finally, no significant common effect was found between the word reading scores of student groups and their grades (F(1,96)=2.30, p>.05, η2=.02), which means that the word reading scores of students in both groups in different grades were similar.

2.3. Data Collection Tools

2.3.1. Evaluation of Word Reading Skills

The word and nonword reading procedure, which was developed by Güldenoğlu (2016), was adopted in this study to identify the word reading performances of children with and without learning disabilities using 42 word pairs (21 word and 21 nonword). During the procedure, the participants were presented with meaningful words and nonword pairs written in both plain text writing and handwriting and asked to read the words they see on the screen as soon as possible and to tell if they are the same or not (Figure 1).

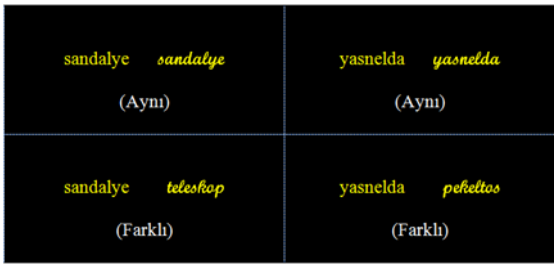

Figure 1. Screenshot examples of meaningful word and nonword reading skills evaluation procedures

2.3.2. Evaluating the Syntactic Comprehension Skill

Include in the Method section information that provides definitions of all primary and secondary outcome measures and covariates, including measures collected but not included in this report. Describe the methods used to collect data (e.g., written questionnaires, interviews, observations) as well as methods used to enhance the quality of the measurements (e.g., the training and reliability of assessors or the use of multiple observations). Provide information on instruments used, including their psychometric and biometric properties and evidence of cultural validity. In this study, a reading comprehension process was developed at the sentence level in order to evaluate the participants' performance of comprehending sentences with different morphological

structures. The evaluation tool used was developed within TÜBİTAK-114K643 (2017) project in order to evaluate the development of students with different features at the grades of 3, 4, 6, 7, 9, and 10. To make use of the evaluation tool, necessary permission was received from the implementor of the relevant project.

Content of the Process: Here, students are presented with 12 sentences describing a single event and options of questions and answers for each sentence, and are asked to read out the sentences and questions in order and mark the option they think are correct for the questions.

In the project, five main criteria are taken into consideration during the development of this process. First, it was made sure that all the words that make up the sentences consist of words that are familiar to students in the third grade, which is the lowest grade in the study. Second, it was made sure that 12 sentences have similar syntactic properties (number of dependent clauses, number of words, etc.). Third, it was made sure that 6 of the 12 sentences consist of words with a more morphologically complex structure than the other 6. Fourth, it was made sure that all sentences with a simple morphosyntactic structure consist of 4 to 5 words, while the complex ones consist of 8 to 9 words. When developing various morphological structures, it was made sure that derivational and inflectional morphemes that are most commonly used in daily life and familiar to students are used. Fifth, it was made sure that six of the questions about sentences were passive while the other six were active. Finally, half of the sentences in both groups were asked using active mode and the other half using the passive mode. As it was prepared to be applied using pen and paper, the participants' responses were calculated by the practitioner as 1 point for each correct answer and 0 points for each wrong answer.

2.4. Data Collection and Analysis

The evaluation session was held in two stages during the fall semester of the school year (2020-2021). Before proceeding to the application, students were interviewed individually to briefly explain what the purpose and content of the application were. Applications were conducted during approximately 15-minute individual sessions with students with learning disabilities at the private educational facilities they are attending and with students with normal development at designated areas in their schools.

In all the sessions conducted during the research, students were first presented with a word reading test on a computer, and then the process used to evaluate sentence comprehension skills was applied to participants individually. The content of the evaluation tools used is described above. In the process of encoding data to SPSS, all evaluation tools were encoded twice by the author and a subject-matter expert and the inter-rater reliability criteria were met for each evaluation tool. The ShapiroWilk and Kolmogorov-Smirnov normality tests were performed to examine the distribution of the

dependent variables studied, and values of kurtosis and skewness of the scores were analyzed. The Mann Whitney U was performed to compare groups because the syntactic comprehension skill scores obtained by students with and without learning difficulties did not show normal distribution. Cohen's (1988) effect size calculation formula (*d*) was made use of to examine the effect sizes of the values obtained as a result of comparing groups. The effect size was considered to be small if (d level) is less than .20, medium if .50, and large if higher than .80.

3. Results

Syntactic comprehension performances of groups were analyzed by comparing the simple syntactic and complex syntactic comprehension scores and the score that is the sum of these two scores. Table 2 presents findings on the comparison of syntactic comprehension performances.

Table 2.

Grade	Group	$\overline{x}$	SD	Mean Rank	Total Rank	*U*	p	Effect Size
Syntactically Simple								
4th Grade	LD	3.92	1.525	19.38	484.50	159.50	.002	.44
	ND	5.20	1.29	31.62	790.50			
6th Grade	LD	3.52	1.228	15,32	383,00	58.00	.000	.74
	ND	5.72	.842	35.68	892,00			
Syntactically Complex								
4th Grade	LD	3.80	1.414	18.38	459.50	134.50	.00	.51
	ND	5.28	1.242	32.62	815.50			
6th Grade	LD	2.80	1.154	14.14	353.50	28.50	.00	.81
	ND	5.56	.916	36.86	921.50			
Total Syntactic Comprehension								
4th Grade	LD	7.72	2.557	18.16	454.00	129.00	.000	.51
	ND	10.48	2.238	32.84	821.00			
6th Grade	LD	6.32	2.154	13.96	349.00	24.00	.000	.81
	ND	11.28	1.458	37.04	926.00			

The simple syntactic comprehension performances in Table 2 show that compared to their peers diagnosed with dyslexia, 4th graders with normal development (U= 159.50, p<.05, d= .44) and 6th graders with normal development (U= 58.00, p<.05, d= .74) performed significantly higher.

The complex syntactic comprehension performances show that compared to their peers diagnosed with dyslexia, 4th graders with normal development (U= 134.50, p<.05, d= .51) and 6th graders with normal development (U= 28.50, p<.05, d= .81) performed significantly higher.

Finally, according to the total syntactic comprehension performances, 4th graders with normal development (U= 129.00, p<.05, d= .51) and 6th graders with normal development (U= 24.00, p<.05, d= .81) performed significantly higher compared to their peers diagnosed with dyslexia.

When the results of the analysis combined, they show that the syntactic comprehension performance of students diagnosed with dyslexia at all grades was significantly less well than that of students with normal development and the effect sizes of differences between groups were medium and large.

4. Discussion

The general purpose of this study is to examine the syntactic comprehension skills of students with and without dyslexia who receive education at different grades. The results of the analysis show the total syntactic comprehension scores of students with dyslexia to be lower than those of students with normal development. According to the relevant literature, the reason for this difference is the limitations of phonetic knowledge and skills, and therefore word-reading skills of readers (Caravolas et al., 2005; Johnston & Kirby, 2006; Katzir et al., 2006; Nation & Snowling, 2004; Savage & Frederickson, 2005; Shaywitz & Shaywitz, 2005; Vellutino et al., 2004).

When it comes to syntactic comprehension, two main skills come into play (Güldenoğlu et al., 2015). One of them is the skill to process words (decoding and comprehension), while the other is the skill to perform morpho-syntactic analysis, which is the higher stage so that this skill can go up to the sentence level. Given the participant selection criteria used in the study and the general characteristics of the processes, it is clear that the differences in the syntactic comprehension performance of student groups could not be caused by their word processing skills. To be more clear, both the fact that all students perform similarly in word analysis skills and the fact that words in sentences involved in syntactic comprehension are simple and familiar for the students involved in the study are considered to be the most important evidence to support this view. From this perspective, it can be said that at first glance, the difference in sentence comprehension stems from the limited morpho-syntactic analysis skills of student groups.

The detailed analysis of findings shows that the average score of syntactic comprehension of students with dyslexia decreases according to the morphological complexity of sentences and the grades of students. This finding indicates that students with dyslexia at different grades try to make sense of all sentences in the process of syntactic comprehension using a strategy other than the morpho-syntactic analysis, which they also cannot use effectively. Because if they had used the morpho-syntactic analysis, albeit ineffectively, student scores would still have to differ in favor of morpho-syntactically simpler sentences. At the same time, given that these results show that students tend to make use of a similar strategy in both types of sentences, which is not the morpho-syntactic analysis strategy, we can say that students with dyslexia involved in the study try to adopt a different strategy while trying to comprehend sentence.

Students show that readers that exhibit adequate performance in the word processing skill but limited performance in syntactic knowledge and skill usually overlook the -syntactic properties of sentences and try to use a deductive strategy during comprehension görülmüştür (Güldenoğlu et al., 2015; Miller, 2000; 2005; 2010). We can see that readers first process the words in a sentence, and then analyze the processed words in the context of the syntactic properties of sentences to reach the desired message of the sentence. These studies also note that readers must definitely possess sufficient syntactic knowledge and skills to effectively use the induction strategy when comprehending sentences (Güldenoğlu et al., 2012; Miller, 2000; 2005; 2010). This indicates that the limitations in the syntactic comprehension skills of students with dyslexia involved in the study are limited in terms of the strategy they are trying to use.

Students with dyslexia in the study received lower comprehension scores in comprehending syntax in a complex structure than in a simple structure. According to studies in the literature that analyze the impact of syntactic complexity on students' performance on syntactic comprehension, students need to possess the appropriate syntactic knowledge and skills to correctly interpret the intended messages even though they have enough information about events and words in sentences (Güldenoğlu et al., 2015; Miller, 2000; 2005; 2010; Tily et al., 2010). These studies note that students with limited syntactic knowledge and skills show lower comprehension performance due to increased syntactic complexity. From this point of view, the results obtained from this study appear to be consistent with the literature. The high performance of students with normal development in comprehending complex syntax than their peers diagnosed with dyslexia is thought to be associated with the fact that they do not have a diagnosed learning disability, more written and verbal exposure of complex wording due to literacy skills, and past literacy experiences. In a language such as Turkish, which is agglutinative where a word can have an infinite number of suffixes, the limited syntactic comprehension performance of students with dyslexia may have been caused by their limited experience.

Many linguists divide grammar into three parts: "phonology, syntax and morphology". Due to the close relationship between syntax and morphology, research usually deals with both at the same time. Therefore, the concept of syntax in this study also includes morphology. Studies comparing the morphological knowledge and skills of children with dyslexia with their peers found that those with dyslexia performed less well (Abu-Rabia, 2007; Casalis et al., 2004; Chung et al., 2010; Schiff & Raveh, 2007; Siegel, 2008; Tsesmeli & Seymour 2006). Based on these results, it is suggested that the limitation in the syntactic comprehension performance of students with dyslexia may be stemming from their limitation in morphological knowledge and skills. For example, given the morphological structure in the sentence '*Annemler dün parka gittiler' (my parents went to the park yesterday)*, the plural *annemler* led to the use of the plural verb *gittiler*. From this point of view, it will not be enough for readers to only read the words correctly in order to correctly comprehend the message that is intended to be relayed in the sentence. It is also important for them to correctly analyze the morpho-syntactic structures in sentences and correctly understand the morphemes added to words while decoding them. Only in this way will they be able to comprehend what they are reading, which is the ultimate goal of reading. Therefore, the findings of the study once again showed us that the linguistic features of Turkish should not be ignored.

As a result, all the findings together show us that students with dyslexia at different grades have major limitations in their ability to comprehend syntax. It is believed that the factor affecting this result is the limited syntactic knowledge and skills that students with dyslexia have, as well as their limited knowledge and experience of the comprehension strategies they adopt. In addition, this study is important for showing that the limitations experienced by students with dyslexia in syntactic comprehension cannot be explained by word reading skills and that they must have sufficient syntactic knowledge and skills. The findings of the study are believed to add a significant contribution to explaining the difficulties experienced by readers who are limited in their comprehension skills and to developing effective reading intervention programs targeting such individuals.

This study has several limitations. First, a limited number of students were included in the study, which makes it difficult to generalize its findings. For this reason, more students from different grades should be included in future studies. Second, this study is a cross-sectional one, and therefore it is important that future longitudinal studies show the development of syntactic comprehension skills. Third, in this study, a single method was used to evaluate the skill to comprehend syntax, and in this case it may have limited the results. A detailed assessment can be made by using assessment tools such as sentence-image matching, sentences containing unfamiliar events while evaluating the skills to comprehend syntax in future research. Finally, the fact that a reading age-appropriate group of students was not included is not sufficient to explain the reason behind the limitation in the ability to comprehend syntax.

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