



**SPELLING ERRORS OF DYSLEXIC CHILDREN IN TRANSPARENT  
ORTHOGRAPHY: SPECIFIC DEFICIT OR DEVELOPMENTAL DELAY?**  
**GREŠKE U PISANJU KOD DJECE SA DISLEKSIJOM U TRANSPARENTNOJ  
ORTOGRAFIJI: SPECIFIČAN DEFICIT ILI KAŠNJENJE U RAZVOJU?**

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**ABSTRACT**

The aim of this paper was to analyze the spelling errors of children with dyslexia, in order to determine whether they have a specific pattern of spelling errors or are simply late in acquiring spelling skills. The sample included 30 children with dyslexia and 30 spelling-level-matched younger children. The research was conducted in the area of Sarajevo Canton and Tuzla Canton in the period from March to May 2022. The results showed that children with dyslexia make similar patterns of errors as spelling-level-matched group. The obtained results show that children with dyslexia in transparent orthography do not have a specific deficit in spelling, but rather delay in acquiring spelling skills.

**Key words:** dyslexia, transparent orthography, spelling errors, specific deficit, delay.

**SAŽETAK**

Cilj ovog istraživanja bio je analizirati greške u pisanju djece s disleksijom, kako bi utvrdili da li imaju specifičan obrazac grešaka u pisanju ili jednostavno kasne u sticanju vještine pisanja. Uzorkom je bilo obuhvaćeno 30 djece sa disleksijom i 30 djece iste dobi po vještini pisanja. Istraživanje je sprovedeno na području Kantona Sarajevo i Tuzlanskog kantona u periodu od marta do maja 2022. godine. Rezultati su pokazali da djeca sa disleksijom prave slične obrasce grešaka kao i mlađa djeca tipičnog razvoja usklađena prema vještini pisanja. Dobiveni rezultati pokazuju da djeca sa disleksijom u transparentnoj ortografiji nemaju specifičan deficit u pisanju već kasne u sticanju vještine pisanja.

**Ključne riječi:** disleksija, transparentna ortografija, greške u pisanju, specifični deficit, kašnjenje.

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## INTRODUCTION

According to the latest Diagnostic and Statistical Manual of Mental Disorders, DSM-V (2013), developmental dyslexia is characterized by difficulties in word reading accuracy reading rate or fluency as well as reading comprehension in despite normal intelligence, the absence of sensory deficits and adequate instruction and socio-cultural circumstances. Also, it is known that children with dyslexia not only have deficits in reading, but also in spelling (Maughan et al., 2009). However, while reading difficulties have been extensively studied, writing problems have received significantly less attention (Döhla and Heim, 2016). As a result, clinical and scientific knowledge about dyslexia has grown exponentially in recent years, and while developmental dyslexia has been the focus of research, research into writing disorders were neglected.

Nevertheless, a certain number of studies that have been analyzed spelling errors of dyslexic children determined certain aspects that give a better picture of the cognitive mechanisms of spelling and learning of it (Protopapas et al. 2012). But be mindful of the fact that spelling is based on phonological awareness and that the type of orthography has a significant influence (Furnes and Samuelsson, 2010), the knowledge we have cannot be generalized to all languages. Namely, according to the degree of phoneme-grapheme correspondence, orthographies are distributed on a continuum from transparent or shallow with almost perfect mapping of phonemes to graphemes to completely deep orthography where, depending on the context, the same letter can represent different phonemes and the same phoneme can be represented by different letters (Frost et al., 1987). According to Seymour et al (2001), English is considered a language with a deep orthography containing many inconsistencies and complexities, while some other European languages have a shallow or transparent orthography with a consistent grapheme-phoneme correspondence such as Finnish, Greek, Italian and in Spanish. However, an example of extremely transparent orthography is the Bosnian/Croatian/Serbian language. The results of other research have shown that in languages that are considered languages with transparent orthography, the largest number of spelling errors are orthographic type of errors (Ise and ShultzE-Körne, 2010), such as the Italian language in which children with dyslexia had the most errors of this type. (Angelelli 2004, 2010). An interesting study by Andreou and Baseki (2012) where they compared children who speak Greek as their mother tongue, a language with a relatively transparent orthography, and English as a foreign language (a language with deep orthography), revealed that children with dyslexia make more phonological-type errors in English language than in the Greek language.

Also, Nikolopoulos et al. (2003) determined that children with dyslexia who speak Greek make the most orthographic and morphological type of errors, while they do not make phonological type of errors. In a language such as Bosnian with completely transparent orthography, Duranović (2017) found that phonological type of errors are the most prevalent. The increased number of phonological type of errors supports the hypothesis of phonological processing deficit in children with dyslexia.

Certain progress in research has been made regarding the determination of the types of spelling errors in children with dyslexia, however, there is a very small number of studies in transparent orthographies that compared groups of children with dyslexia and spelling-level-matched children.

Bryant and Goswami (1986) suggested that for processing skills to be considered the cause of reading difficulties, it is not enough to prove that people with dyslexia perform worse than children of the same chronological age and normal intelligence because the deficit may simply reflect differences in reading ability and exposure to written content. A group of younger children matched for intelligence and reading ability should also be included in studies investigating dyslexia. If children with dyslexia perform worse than children of the same reading level on the examined processing skills, then it could be considered as a potential cause of their reading difficulties or as a secondary deficit related to a primary deficit that also causes dyslexia. Study design like this is according to Bryant and Goswami (1986) based on the assumption of bidirectional relationships between cognitive processes and reading skills or exposure.

Study designs with control groups of the same reading level have been used with considerable success with English-speaking participants (Greaney & Tunmer, 1996; Manis & Bailey, 2008; Richardson, Thomson, Scott, & Goswami, 2004). However, research in transparent orthographies that also had a cohort of the same reading level reported conflicting findings (e.g., Constantinidou & Stainthorp, 2009; Diamanti et al., 2018; Georgiou et al., 2010; Papadopoulos et al., 2012; Serrano and Defior, 2008; Soriano & Miranda, 2010; Tobia & Marzocchi, 2014). The aim of this study is to compare children with dyslexia and children of the same spelling level in order to obtain clearer results about the real deficit, that is, the presence of a developmental delay in the writing skills of children with dyslexia for transparent orthography. Research by Katzir et al. (2006) who compared children with dyslexia and children of the same reading level did not find a typical pattern of spelling errors associated with dyslexia, such as a greater number of phonological type of errors.

Bourassa and Treiman (2003) who examined spelling in English also used control groups of the same spelling-level. Their results determined that there is no difference between children with dyslexia and children of the same spelling level in terms of phonological and orthographic errors. Two years later Cassar et al. (2005), also found no significant difference between the types of writing errors of children with dyslexia and children of the same age in terms of spelling skills. Bernstein (2009) came to similar findings, finding that the writing of vowels does not differ between children with dyslexia and children of the same reading level. However, depending on the particular language, orthography varies in its phonological representation and phonological consistency (Zigler and Goswami, 2005). The authors believe that the size of the units used for reading according to the sub-lexical route varies between children and adults, depending on orthography. Thus, it is considered that there are differences in mastering this skill through languages. In languages with transparent orthography, the development of phonological abilities is faster. Long before, Caravolas and Bruck (1993), comparing children who speak English and Czech, found out that children who learn a language with transparent orthography, such as Czech, master spelling faster than children who learn a language with deep orthography, such as English.

Given that, most of the existing research in this area has been conducted in languages with non-transparent/deep orthography or relatively transparent orthography, our current understanding of spelling difficulties in children with dyslexia is still limited. Orthography in our language is a specific example of extremely transparent orthography where grapheme-phoneme correspondence is one-to-one. Each letter is pronounced in only one way, regardless of which letter precedes or follows it. The alphabet has 30 letters, 5 vowels and 25 consonants. We have 3 specific letters—/dž/, /lj/, and /nj/—that consist of two characters that are treated as one letter. Children are taught that if these two signs appear together next to each other, they are treated as one letter (Duranovic, 2017). Bearing in mind the mentioned specificities, the aim of our study is to determine whether the types of spelling errors differ from the spelling errors of younger children matched by spelling level. Our study is an extension of Duranovic's (2017) study, where, using the same methodology, we tried to determine whether children of the same spelling level will make a most of phonological type of errors. Our assumption is that in highly transparent orthography, younger children have superior phonological abilities compared to older children with dyslexia and that they will show a different pattern of errors, that is, that the difficulty in spelling is basically a deficit and not a developmental delay.

## **MATERIAL AND METHODS**

### **Sample of participant**

The research, which was conducted in the Sarajevo and Tuzla Cantons, included 30 children with dyslexia in the third, fourth and fifth grades (16 boys and 14 girls) who learned Latin as the first script. The average age of the respondents was 10.02 years. Children with dyslexia were determined according to the recommendations stated in the medical classification of diseases DSM V (American Psychiatric Association, 2013). Children with dyslexia are children without intellectual difficulties, neurological and sensory deficits, the accuracy and speed of reading measured by individualized tests must be significantly lower than expected considering chronological age and age-appropriate education.

The control groups were obtained by the method of equivalent pairs in relation to chronological age and in relation to the spelling skills. The chronological age group was group of normally achieving children, without spelling problems and the same age as dyslexic group. The spelling level group consisted of younger children of the first, second and third grade, of the same spelling level, also a total of 30 of them (16 boys and 14 girls). The average age of the respondents was 8.01 years.

For the examination of both groups, Raven's Coloured Progressive Matrices (Raven, 1956) were applied by a qualified psychologist, in order to rule out intellectual disabilities, while data on sensory deficits (vision or/and hearing impairment) were taken from school records. To determine dyslexia, a task from the Dyslexia Assessment Test (Duranović, 2013) was used.

## Method of conducting research

Teachers were asked to single out children with reading and writing difficulties. The children singled out by the teachers were assessed individually with tests for the assessment of one-minute reading, reading real words and non words, and spelling according to dictation contained in the Dyslexia Assessment Test (Duranovic, 2013). After that, the respondents whose result was below the 10th percentile in reading speed or reading and writing accuracy were singled out.

## Measuring instruments

A battery of tests for the assessment of dyslexia (Duranovic, 2013) was used, i.e. the eighth and ninth task. The spelling tasks were created to assess spelling skills by dictation for words that progressively increase in length and difficulty, and for words that follow phonological alternations of consonants. During the examination, the examiner reads the words that the children write down. One point is given for each correctly written word, so the maximum possible number of points for the eighth task is 50, while for the ninth task it is 35. The eighth task from the dyslexia assessment test is actually spelling familiar words task. All words follow the rules of transparent grapheme-phoneme correspondence. The words are familiar to children of primary school age and offer the possibility of various mistakes. The words vary in length, so we have three, four, five, six and twelve letters words. Each group consisted of 10 words. The ninth task from the dyslexia assessment test consisted of 35 words that follow phonological alternations of consonants. This word structure was needed in order to examine spelling errors. Duranovic (2017), explains in her methodology that all words follow phonological alternations of consonants (assimilation by voice, assimilation by place of articulation, loss of consonants). During the examination, the children were given the task to spelling words on a blank sheet of paper under dictation. The examination was carried out individually.

## Error classification

The same errors classification was used as Duranovic (2017), three types of errors were determined, respectively: phonological, grammatical and orthographic errors.

Phonological errors refer to a written word that shares phonology with the target word and that sounds similar to the target letters in the word. The phonological principle is violated and the written word is pronounced differently from the target word (e.g. "biti" for "piti"; "zima" for "sima"; "slab" for "slap") (Protopapas et al., 2013; Tops et al. al., 2012). In accordance with the classification of Protopapas et al. (2013) and Duranović (2017), these errors are further classified into the following subcategories: omissions (e.g. "vata" instead of "vrata"), substitutions (e.g. "kalta" instead of "karta"), inersrtions (e.g. "plas " instead of " pas"), and transpositions (e.g. "parh" instead of "prah").

Grammatical errors are associated with a lack of knowledge of the grammatical rules of the Bosnian/Croatian/Serbian language. Grammatical errors are manifested by impaired grammatical word formation. In this language, these errors mostly refer to the incorrect use of prefixes or suffixes (eg "graničnost" instead of "bezgraničnost"; "nos" instead of "nošac").

Orthographic errors refer to errors that do not follow the rules of using written characters in the Bosnian/Croatian/Spanish language. According to Jahić et al. (2000) these errors refer to the incorrect use of rules related to how letters and words are spelled and how words are spelled in terms of the space between them regardless of how they are pronounced (pronounced "pret kućom " but written "pred kućom"). Assimilation is mainly reflected in orthography, so the most common orthographic errors in the Bosnian/Croatian/Serbian language occur due to the omission of the rules for consonants assimilation. Assimilation by voicing (e.g. "odstraniti" instead of "othraniti"), assimilation by place of creation (e.g. "stanbeni" instead of "stambeni") and loss of consonants (e.g. "zadatci" instead of "zadaci") were analyzed separately. Another type of orthographic errors are errors where the rules of ije/je transition are not followed (e.g., cvjet instead of cvijet).

### Data processing methods

Data analysis was performed using a package for statistical data processing for social sciences (SPSS for Windows, version 20.0). Descriptive statistics methods were used in the paper, where the arithmetic mean, standard deviation are shown. Differences between the studied groups were determined by ANOVA test.

## RESULTS

Table 1 shows the mean values and standard deviations for the examined groups of children. Children with dyslexia scored below the 10th percentile on all tasks and had significantly lower results comparing to chronological age control group. In the tasks of spelling under dictation of familiar words (spelling1) and spelling under dictation of words that follow phonological alterations of consonant (spelling2), no differences were found between children with dyslexia and children of the same spelling skills, which confirms the correct determination of the investigated groups. Children with dyslexia on the task of spelling under dictation achieved an average value of 37.36, and children of the same spelling level achieved an average value of 37.80, while on the task of spelling under dictation of words that follow phonological alterations of consonant, children with dyslexia achieved an average value of 20.13, while children of the same spelling level 20.43.

Table 1. Test scores for dyslexic and control groups

	Children with dyslexia		Chronological age control		Spelling level control	
	Mean	SD	Mean	SD	Mean	SD
spelling1	37.36	5.34	46.80**	2.86	37.80	4.96
spelling2	20.13	5.89	30.10**	4.69	20.43	5.28
IQ	25.30	2.56	26.00	3.45	22.16	1.94

Spelling 1 – spelling familiar words; Spelling 2 - spelling words that follow the phonological alterations of consonant phonologically; IQ-average of individual intelligence coefficients according to the Test of Standard Progressive Matrices; \*\*  $p < .01$

Table 2 shows the types of spelling errors made by children with dyslexia and children of the same spelling level.

Mean values indicate somewhat higher values in children with dyslexia compared to children of the same spelling level in terms of phonological and orthographic types of errors, however, this difference is not statistically significant. A slightly higher average value was obtained for grammatical errors in children of the same age in terms of writing skills than in children with dyslexia, although the difference is not statistically significant. The results show that both groups of respondents made the most phonological, then orthographic, and the least grammatical errors.

Table 2. Differences in errors types between children with dyslexia and spelling-level matched children

Type of errors	Children with dyslexia		Spelling Level Children		F	p
	Mean	SD	Mean	SD		
Phonological	49.16	8.76	47.00	7.59	1.048	.310
Grammatical	5.00	3.59	5.70	2.64	.740	.393
Orthographic	13.60	3.28	12.80	3.87	.744	.392

Table 3 shows the results of the subcategory of errors. The results show that there are differences between the group of children with dyslexia and children of the same spelling level in relation to subcategories of the phonological type of errors, i.e. in errors related to substitutions and omissions, in the sense that children of the same spelling level make more omissions in relation to children with dyslexia and this difference is statistically significant at the  $p < .01$  level. Also, when it comes to substitutions, it was found that children of the same spelling level make more substitutions compared to children with dyslexia and this difference is statistically significant at the  $p < .05$  level. Regarding the other subcategories of errors, there was no significant difference between the two examined groups.

Table 3. Differences between children with dyslexia and spelling-level matched group in terms of spelling errors by subcategories

Variable	Children with dyslexia		Spelling Level Children		F	p
	Mean	SD	Mean	SD		
Omission	6.83	2.66	9.50	3.89	9.58	<b>.003</b>
Substitutions	6.43	1.17	7.84	1.17	4.95	<b>.030</b>
Insertions	2.90	2.53	2.60	1.84	.274	.603
Transpositions	2.26	2.31	1.83	1.93	.619	.435
Wrong utilization of prefix	2.20	2.26	2.16	1.62	.004	.948
Wron utilization of suffix	2.96	2.26	3.56	1.95	1.203	.277
Assimilation by voicing	6.46	2.37	5.73	2.85	1.17	.284
Assimilation by place of articulation	3.30	1.72	3.20	1.95	.044	.834
Loss of consonants	2.10	1.64	2.16	1.62	.025	.875
Disrespected rules about alternations in ije/je	1.63	1.58	1.63	1.65	.000	1.000

## DISCUSSION

The aim of this research was to analyze the spelling errors of children with dyslexia, in order to determine whether they have a specific pattern of spelling errors or are simply late in acquiring spelling skills. The results showed that the pattern of errors in children with dyslexia and spelling-level-matched children are the same, that is, the most frequent errors in spelling are phonological type of errors, followed by orthographic errors, while grammatical type of errors are the least frequent. The results obtained in this research are consistent with the results of Bourassa and Treiman (2003), who found that children with dyslexia make the same pattern of errors as typical children of a younger age, but of the same spelling skills. According to Ziegler and Goswami (2005), typical children are better on phonological awareness tasks (among other things knowledge of phoneme-grapheme correspondence) in languages with transparent orthography. In this research, children with an average age of eight made the most phonological errors, which shows that this aspect has not yet been mastered in spelling, even though it is transparent orthography. The obtained results support the assumption that the development of writing skills in children with dyslexia is similar in nature to children of a younger age, and in no way qualitatively different. That is, children with dyslexia are delayed in acquiring spelling skills, but they use the same processes and strategies for learning to write and show the same patterns of errors as younger children of the same writing skills. Orthographic errors, after phonological type errors, are the most prevalent in both examined groups. The Self-teaching hypothesis (de Jong and Share, 2007) states that children who have good phonological decoding skills can improve orthographic processing, which would mean that consequently this type of error appears as the second most frequent, right after phonological. On the other hand, even Landerl and Wimerl (2008) found in the German language that children with dyslexia still make the most errors of the orthographic type, even though they have good phonological skills, which implies that they have not achieved this form of learning. Grammatical type errors are the least represented errors in both examined groups. Studies by Egan and Tainturier (2011), conducted in English, language with deep orthography, showed that children with dyslexia have a specific grammatical deficit compared to younger children with the same spelling skills, while this was not confirmed in our research. Duranović et al. (2014) found that children with dyslexia have a specific deficit in terms of morphological knowledge (which refers to knowledge of grammar) compared to children of the same chronological age and children of the same reading level, where children with dyslexia had significantly worse achievements compared to both control groups when it comes to the oral examination. Treiman and Bourasa (2000) determined that there can be differences in achievements in relation to the way of examination, oral and written, that is, children show better results when they put it in a visual form (writing on a sheet of paper). The research results showed that younger children of the same spelling level make more omissions and substitutions when spelling under dictation than children with dyslexia. Such results are surprising, i.e. the higher prevalence of omissions and substitutions in spelling level-matched-children was not expected, given that these types of errors are the core deficit in children with dyslexia in transparent orthography.



Duranović (2017) determined that omissions are most frequent in third and fourth grades, while substitutions are most frequent in older grades. However, Hoffman and Norris (1989) pointed out that initial spelling follow the normal phonological processes first employed in children's speech, including systematic simplifications, omissions, and substitutions of phonemes and syllables. Children usually omit consonants from a group, make mistakes in voiced/unvoiced consonant pairs, or replace front consonants with back consonants. First grade children learning to write often treat some phonemes as units within a syllable, especially if the vowel is followed by a nasal (jump/jup) (Treiman, 1993). Such errors often show a still underdeveloped phonemic awareness, which is a key prerequisite for reading and writing. However, it is also interesting that Parilla et al. (2020) determined that the formation of control groups of the same reading level compared to children with dyslexia based only on reading measures can result in the groups differing not only on other reading tasks, but also on additional relevant characteristics, such as: general language abilities, general knowledge, experience in reading, which are key variables for proper group formation. As a consequence, it is possible that older children with dyslexia achieve the same score on text and word reading because they rely on better vocabulary or specific word knowledge. Perhaps, a similar design should be applied when dealing with a control group of children of the same spelling level, i.e. apply additional measurements in addition to the spelling task.

## CONCLUSION

The aim of this study was to determine whether children with dyslexia show different patterns of errors compared to children of typical development, of a younger age, and of the same spelling level. Our results showed that children with dyslexia show the same pattern of errors they make during spelling as younger children with typical development. They are more likely to use the same spelling strategies and processes as beginners. Also, these findings indicate that children with dyslexia should benefit from instructions that follow the typical development of the acquisition of spelling skills. Also, the recommendation for future research is to conduct the same examination at an older age to see if the similarities still persist or differences between the examined groups will emerge. Also, it would be good to include the effects of lexicality in the methodology, as were, spelling real words and non words in order to exposed the phonological skills and examine phonological ability of children with dyslexia compared to children of the same spelling level.

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