

ORTHOGRAPHIC PERFORMANCE PROFILE OF STUDENTS WITH DYSLEXIA AND LEARNING DIFFICULTIES

DESEMPENHO ORTOGRÁFICO DE ESCOLARES COM DISLEXIA E DIFICULDADES DE APRENDIZAGEM

PERFIL DE DESEMPEÑO ORTOGRÁFICO DE ESTUDIANTES CON DISLEXIA Y DIFICULTADES DE APRENDIZAJE

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ABSTRACT: It is described in the literature that students with specific learning difficulties and disorders may present difficulties in the spelling appropriation of the Brazilian Portuguese writing system, however little is discussed about which errors are most committed by these populations. Thus, this study aimed to characterize and compare the orthographic performance of students with Dyslexia, Learning Disabilities and good academic performance. 75 school children participated, from 9 to 11 years old, divided into 3 groups and matched by diagnosis and school year. Spelling was evaluated by dictating words and pseudowords based on the semiology of errors. The results were compared statistically by the Kruskal-Wallis test adjusted by the Bonferroni Correction, where it was possible to observe that the spelling profile of students with dyslexia and learning difficulties are similar, while the profile of students with good academic performance differs from the other groups, also concluding that the Pseudowords Dictation test is the best to differentiate students with Dyslexia of students with learning difficulties and good academic performance.

KEYWORDS: Dyslexia. Evaluation. Learning. Specific learning disorder. Handwriting.

RESUMO: É descrito na literatura que escolares com dificuldades e transtornos específicos de aprendizagem podem apresentar dificuldades na apropriação ortográfica do sistema de escrita do português brasileiro, porém pouco é discutido sobre quais os erros mais cometidos por estas populações. Desta forma, este estudo teve por objetivo caracterizar e comparar o desempenho ortográfico dos escolares com Dislexia, Dificuldades de Aprendizagem e bom desempenho acadêmico. Participaram 75 escolares, de 9 a 11 anos de idade, divididos em 3 grupos e pareados por diagnóstico e ano escolar. Foi realizada a avaliação da ortografia por meio de ditado de palavras e pseudopalavras a partir da semiologia dos erros. Os resultados foram comparados estatisticamente pelo Teste de Kruskal-Wallis ajustado pela Correção de Bonferroni, onde foi possível observar que os perfis ortográficos de escolares com dislexia e dificuldades de aprendizagem se assemelham, enquanto o perfil de escolares com bom desempenho acadêmico difere dos demais grupos, concluindo, também, que a prova de Ditado

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de Pseudopalavras é a melhor para diferenciar escolares com Dislexia dos escolares com dificuldades de aprendizagem e bom desempenho acadêmico.

PALAVRAS-CHAVE: *Dislexia. Avaliação. Aprendizagem. Transtorno específico de aprendizagem. Escrita manual.*

RESUMEN: *Se describe en la literatura que los estudiantes con dificultades y trastornos de aprendizaje específicos pueden presentar dificultades en la apropiación ortográfica del sistema de escritura portugués brasileño, sin embargo poco se discute sobre cuáles errores son más cometidos por estas poblaciones. Así, este estudio tuvo como objetivo caracterizar y comparar el desempeño ortográfico de estudiantes con Dislexia, Discapacidades de Aprendizaje y buen desempeño académico. Participaron setenta y cinco alumnos, de 9 a 11 años, divididos en 3 grupos y emparejados por diagnóstico y año escolar. La ortografía se evaluó dictando palabras y pseudopalabras en función de la semiología de los errores. Los resultados se compararon estadísticamente mediante la prueba de Kruskal-Wallis ajustada por la Corrección de Bonferroni, donde se pudo observar que el perfil ortográfico de los estudiantes con dislexia y dificultades de aprendizaje son similares, mientras que el perfil de los estudiantes con buen desempeño académico difiere de los otros grupos, concluyendo también que la prueba de Dictado de Pseudopalabras es la mejor para diferenciar a los estudiantes con Dislexia de alumnos con dificultades de aprendizaje y buen rendimiento académico.*

PALABRAS CLAVE: *Dislexia. Evaluación. Aprendizaje. Trastorno específico de aprendizaje. Escritura manual.*

Introduction

The school student with a good academic performance is the one who can perform his/her school activities efficiently, reaching the final objective, which is learning (BORKOWSKI, 1992). However, it is known that some students present academic performance below the ideal (PASTURA; MATTOS; ARAÚJO, 2005), being necessary to consider the influencing aspects of this performance below the expected, such as pedagogical or neurodevelopment characteristics.

According to the American Psychiatric Association (DSM-5, 2014), Specific Learning Disorder is a neurodevelopmental disorder, with cognitive abnormalities and associated with behavioral abnormalities.

DSM-5 (2014) states that Specific Learning Disorder with Impairment in Reading (F81.0) may be replaced by the alternative terminology of "Dyslexia" when it is in reference to a pattern of learning difficulties characterized by problems in accurate or fluent word recognition and decoding problems. If the term Dyslexia is used to specify this particular pattern

of difficulties, it is important to also specify any additional difficulties that are present, such as spelling difficulties, difficulties in reading comprehension or mathematical reasoning.

In important published studies (SHAYWITZ; LYON; SHAYWITZ, 2006; REID, 2016), Dyslexia is defined as a specific disorder of neurological origin with impairment in reading and writing, where the student has difficulty in reading fluency, decoding and spelling words. These students have phonological, cognitive-linguistic deficits and changes in motor and visuomotor skills.

In addition to the DSM-5 (APA, 2014), there is a national study (GERMANO; CAPELLINI, 2011) on the interdisciplinary evaluation criteria for schoolchildren to be considered dyslexic. Following this assessment, for a schoolchild to be considered dyslexic they need to present the following manifestations:

- alteration in static balance and appendicular coordination, motor persistence, dynamic balance, trunk-member coordination, and sensitivity in the evolving neurological examination;
- normal cognitive level, change in memory on neuropsychological battery;
- phonological awareness alterations, oral reading speed below that expected for age and schooling, performance considered inferior in reading tests of isolated words and serial texts, performance below that expected in writing tests under dictation, and reading comprehension considered partial of the text read.

Learning disabilities are described as obstacles or barriers that exist during the school's teaching-learning process, referring to difficulties in capturing or assimilating the content proposed by the teachers (REBELO, 1993).

A study (MARTIN; MARCHESI, 1995) states that learning disabilities can be any difficulty presented by the student to keep up with the learning along with their peers. Such difficulties can be long-lasting or transient, with greater or lesser intensity, which may or may not lead the schoolchild to dropout, failure, low performance, delay in learning time or the need for specialized help (DIAS; MONTIEL; SEABRA, 2015).

The students who have doubts during literacy and during the appropriation of orthographic writing may be facing pedagogical problems or dysorthography. When these doubts are not solved even with the appropriate pedagogical intervention and systematic teaching, these students may be showing manifestations of dysorthography. Thus, due to deficits in cognitive-linguistic skills, phonological operational memory and phonographic

conversion, students diagnosed with dyslexia often also have co-occurring dysorthography (BATISTA; GONÇALVES; SAMPAIO, 2010; NOBILE; BARRERA, 2016).

Thus, it is common for students with dyslexia to have co-occurring dysorthography, since the deficits required to perform phonographic conversion and linguistic knowledge, which are altered by dyslexia, also bring deficits for learning spelling, since these mechanisms directly influence both diagnoses.

In the national literature, it is possible to find studies on orthographic knowledge in elementary school students (CAPELLINI *et al.*, 2011; ALVES; CASELLA; FERRARO, 2016; SAMPAIO *et al.*, 2017). Such studies are extremely important to demonstrate what the level of orthographic knowledge that Brazilian schoolchildren have about the alphabetic writing system and to know the orthographic characteristics of schoolchildren with dyslexia (CAPELLINI *et al.*, 2011; ALVES; CASELLA; FERRARO, 2016), helping in the knowledge of manifestations that help to make the differential diagnosis of these schoolchildren.

In view of these studies (CAPELLINI *et al.*, 2011; ALVES; CASELLA; FERRARO, 2016; BATISTA; CAPELLINI, 2017), it is possible to observe that schoolchildren with developmental dyslexia have a higher number of univocal phonograph correspondence errors when compared to those with good academic performance and, in general, a lower number of correct answers in dictations. The studies also bring that the school year has an influence on the spelling performance of all the schoolchildren, once they are in the process of acquiring and appropriating the spelling knowledge of Brazilian Portuguese; however, there are no studies in the literature that verify the relationship between schoolchildren with dyslexia and learning difficulty and their spelling performance.

Knowing that schoolchildren with dyslexia have difficulties in Phonological Operational Memory, in information retrieval via lexical route and in phonological and linguistic alterations, this study hypothesizes that the errors of these schoolchildren are caused by such deficits, so the errors will be different from the errors of schoolchildren with learning difficulties and with good academic performance (CHIARAMONTE; CAPELLINI, 2019).

Thus, investigating the profile of spelling performance in schoolchildren with learning problems can help the professional at the time of differential diagnosis, as well as in therapeutic teaching-learning situations of spelling, in the classroom or clinical context.

Based on the above, the purpose of this study was to characterize and compare the spelling performance of schoolchildren with dyslexia, learning disabilities, and good academic performance.

Material and Method

This study was carried out after approval by the Ethics in Research Committee of the institution of origin, under opinion number 1.803.930.

Seventy-five elementary school students of both genders, aged 9 years to 11 years and 11 months, attending the 3rd to 5th grades of elementary school in a Municipal Public School, participated in this study, divided into three groups:

Group I (GI): 25 students with interdisciplinary diagnosis of developmental dyslexia;

Group II (GII): 25 students with learning difficulties;

Group III (GIII): 25 students with good academic performance, that is, without any learning difficulties.

To pair the students, the students from GI were selected first and, based on their age and schooling, the students from GII and GIII were selected in a paired manner. Therefore, each group was composed of 9 students from the 3rd year, 7 students from the 4th year, and 9 students from the 5th year.

The participants in all groups were students regularly enrolled in public schools in the municipality where the University that proposed the study is located in the 2nd semester of 2017, in order to avoid that different materials and methods could cause any bias to the results obtained by this study.

The participants in GI in this study were subjects with an interdisciplinary diagnosis of dyslexia made by an interdisciplinary team from the *Laboratório de Investigação dos Desvívios da Aprendizagem - LIDA* (Laboratory for Investigation of Learning Disorders) - FFC/UNESP - Marília-SP, which included speech, neurological, pedagogical and neuropsychological evaluations. These children were on the waiting list for phonoaudiological care at the Supervised Internship in Phonoaudiological Therapy: Reading and Writing, at the *Centro Especializado em Reabilitação II* (CER-II) of UNESP-Marília, and were not submitted to any type of phonoaudiological, psycho-pedagogical or pedagogical intervention before the evaluation.

The students from GII and GIII were indicated by their teachers as having learning difficulties and good academic performance, respectively. The students were considered to have good academic performance when they showed satisfactory performance in two consecutive bimesters in the evaluation of Portuguese Language and Mathematics, with a grade higher than

5.0, and they were considered to have learning difficulties when they showed unsatisfactory performance in two consecutive bimesters in the evaluation of Portuguese Language and Mathematics, with a grade equal to or lower than 5.0. The 5.0 grade was used because in the public schools where the students were enrolled this was the minimum grade to avoid failure. We excluded the students who had visual, hearing, intellectual, or physical deficiencies mentioned in their school records and who had a history of failing grades.

After this indication, the students were submitted to the application of the School Performance Test - TDE (STEIN, 1994). Only the students who obtained a superior performance in the reading, writing and arithmetic subtests of the TDE were distributed in the GIII of this study, and in the GII, the students who obtained a inferior performance in the reading, writing and arithmetic subtests of the protocol. The TDE was applied and analyzed by the researcher.

After the distribution of students in the groups of this study, all students were submitted to the tests of Word Dictation and Pseudoword Dictation of the Spelling Evaluation Protocol - Pro-Orthography (BATISTA et al., 2014). This procedure was designed to assess the spelling knowledge of students from 1st to 5th grade of elementary school. The protocol is composed of two application versions and ten tests. The collective version is composed of six tests and the individual version is composed of four tests. In this study, we used only two tests from the collective version.

The application of the protocol was done in a 50-minute session, with the tests applied in groups of five or six students, with the session time varying a few minutes because of the writing time of each student. The students from GI took the tests in the university outpatient clinic, because they had already been through an evaluation process in the institution; the students from GII and GIII took the tests in a classroom made available by the school where the data collection was carried out. The students were taken out of class, as authorized by the teacher, to take the tests.

The data obtained were statistically analyzed in order to compare the intergroup results. The IBM SPSS (Statistical Package for Social Sciences) program, version 23.0, was used to analyze the results.

The results were statistically analyzed using the *Kruskal-Wallis* test, adjusted by Bonferroni correction, when statistically significant differences were found in the intergroup comparison.

Results

Table 1 shows the average, standard deviation and p-value resulting from the *Kruskal Wallis* test, regarding the performance, by typology of spelling errors, of GI, GII and GIII in the Word Dictation test of the Spelling Assessment Protocol - Pro-Orthography.

Table 1 - Distribution of the average error values, standard deviation and p-value referring to the performance of GI, GII and GIII in the Proorthography Word Dictation test

Variable	Group	Average	Standard - deviation	Sig. (<i>p</i>)
CF/G	GI	20,28	17,25	< 0,001*
	GII	8,20	6,48	
	GIII	3,80	3,99	
OAS	GI	34,00	31,81	< 0,001*
	GII	13,44	9,76	
	GIII	5,72	5,64	
AOS	GI	1,16	1,72	0,003*
	GII	0,56	0,71	
	GIII	0,08	0,28	
SJIP	GI	0,32	1,15	0,061
	GII	0,40	0,96	
	GIII	0,00	0,00	
CF/GDC	GI	20,60	9,85	< 0,001*
	GII	21,32	7,67	
	GIII	10,80	7,94	
CF/GIR	GI	20,84	9,66	0,001*
	GII	23,24	8,16	
	GIII	13,56	8,03	
APIA	GI	12,64	3,67	0,040*
	GII	14,04	2,88	
	GIII	11,08	4,40	
OA	GI	0,56	1,04	0,153
	GII	0,24	0,60	
	GIII	0,12	0,33	
Word omission DP	GI	1,24	5,02	0,309
	GII	0,08	0,28	
	GIII	0,04	0,20	

Notes: **CF/G**: Univocal phonograph matching; **OAS**: Omission or addition of segment; **AOS**: Alteration in segment order; **SJIP**: Undue Word Separation or Junction; **CF/GDC**: Context Dependent Phonograph Matching; **CF/GIR**: Rule Independent Phonograph Matching; **APIA**: Absence or Inadequate Presence of Accentuation; **OA**: Other Findings; *Kruskal Wallis Test* ($p < 0.05$).

Source: Prepared by the authors

With the application of the *Kruskal Wallis* test, it was possible to observe in table 1 a statistically significant difference between some types of errors, then the Mann-Whitney test with *Bonferroni* correction was applied to verify which of the groups differed most from the others (table 2).

Table 2 – Distribution of the p-value referring to the comparison of the mean errors of GI, GII and GIII in the Pro-Orthography Word Dictation test

Variable	Groups Pair		
	GI X GII	GI X GIII	GII X GIII
CF/G	0,002*	< 0,001*	0,007*
OAS	0,011*	< 0,001*	0,002*
AOS	0,387	0,001*	0,003*
CF/GDC	0,426	0,001*	< 0,001*
CF/GIR	0,277	0,006*	< 0,001*
APIA	0,163	0,218	0,013*

Notes: **CF/G**: Univocal phonograph correspondence; **OAS**: Omission or addition of segment; **AOS**: Change in segment order; **CF/GDC**: Context Dependent Phonograph Correspondence; **CF/GIR**: Rule Independent Phonograph Correspondence; **APIA**: Absence or Inadequate Presence of Accentuation. (*Bonferroni's* alpha = 0.016952)

Source: Prepared by the authors

In the Word Dictation test, it is possible to observe a higher mean number of natural spelling errors (CF/G, OAS, AOS, SJIP) in the students with dyslexia (GI), which is explained by the phonological processing alteration these students present.

When comparing the groups in the Word Dictation test, it is possible to notice that the students with good academic performance (GIII) have a greater domain of contextual spelling rules, i.e., the spelling rules that apply and irregular spelling, i.e., that writing that totally depends on visual memory to be written correctly.

On the other hand, regarding the absence or inadequate presence of accentuation, the students with learning difficulties (GII) and good academic performance (GIII) had higher mean errors and differed from each other. This occurs because most words in Brazilian Portuguese are not accented, which means that most words in the dictation applied are also not accented. In this way, the greatest number of accentuation errors occurs because these students know the forms of accentuation, but still do not understand and use them efficiently, that is, they accent in a syllable which is not tonic, confuse the accents at the moment of using them or accent words which do not have an accent. The students with dyslexia (GI), on the other hand, hardly use accents when writing, which makes them get most of the words right.

Table 3 shows the average, standard deviation and p-value resulting from the *Kruskal Wallis* test, referring to the performance, by typology of spelling errors, of GI, GII and GIII in the Pseudoword Dictation test of the Spelling Assessment Protocol - Pro-Orthography.

Table 3 – Distribution of the average error values, standard deviation and p-value referring to the performance of GI, GII and GIII in the Proorthography Pseudoword Dictation test

Variable	Group	Average	Standard - deviation	Sig. (p)
CF/G	GI	17,68	9,45	< 0,001*
	GII	7,56	5,69	
	GIII	5,28	5,21	
OAS	GI	18,72	12,93	< 0,001*
	GII	9,96	6,37	
	GIII	5,84	2,88	
AOS	GI	1,52	1,50	0,006*
	GII	0,44	0,58	
	GIII	0,56	0,77	
SJIP	GI	0,28	1,06	0,352
	GII	0,08	0,28	
	GIII	0,00	0,00	
CF/GDC	GI	16,60	4,90	< 0,001*
	GII	16,40	5,71	
	GIII	11,28	3,84	
APIA	GI	1,08	0,28	0,306
	GII	1,16	0,75	
	GIII	1,40	0,91	
OA	GI	0,28	0,74	0,356
	GII	0,12	0,33	
	GIII	0,04	0,20	
Word omission	GI	0,08	0,40	0,602
	GII	0,00	0,00	
	GIII	0,04	0,20	

Notes: **CF/G**: Univocal phonograph matching; **OAS**: Omission or addition of segment; **AOS**: Alteration in segment order; **SJIP**: Undue Word Separation or Junction; **CF/GDC**: Context Dependent Phonograph Matching; **CF/GIR**: Rule Independent Phonograph Matching; **APIA**: Absence or Inadequate Presence of Accentuation; **OA**: Other Findings; *Kruskal Wallis* Test ($p < 0.05$).

Source: Prepared by the authors

With the application of the *Kruskal Wallis* test, it was possible to observe in table 3 a statistically significant difference between some of the error typologies, so the Mann-Whitney test with *Bonferroni* correction was applied to verify which of the groups differed most from the others (table 4).

Table 4 – Distribution of the p-value referring to the comparison of the mean errors of GI, GII and GIII in the Pro-Orthography Pseudoword Dictation test

Variable	Groups Pair		
	GI X GII	GI X GIII	GII X GIII
CF/G	< 0,001*	< 0,001*	0,102
OAS	0,008*	< 0,001*	0,002*
AOS	0,004*	0,013*	0,738
CF/GDC	0,938	< 0,001*	0,002*

Notes: **CF/G**: Univocal phonograph correspondence; **OAS**: Omission or addition of segment; **AOS**: Change in segment order; **CF/GDC**: Context Dependent Phonograph Correspondence. (*Bonferroni's* alpha = 0.016952).

Source: Prepared by the authors

In the Pseudoword Dictation test, except for the errors of absence or inadequate presence of accentuation (APIA), it is possible to observe a higher mean number of errors in the students with dyslexia (GI), which is explained by the fact that these students do not have access to the visual lexicon of these words, thus not having any previous information or help to write them, requiring the use of their cognitive-linguistic abilities, phonological operational memory and phonographic conversion, which are deficient due to dyslexia. The fact that they present fewer errors of absence or inadequate presence of accentuation (APIA) when compared to the students with learning difficulties (GII), is due to the fact that the students with dyslexia do not use accentuation during their writing and, therefore, get it right more often, because, as previously mentioned, most words in Brazilian Portuguese are not accented.

When comparing the groups in the Pseudoword Dictation test, it is possible to characterize the school-aged children with dyslexia (GI) as the ones who present more univocal phonographic correspondence errors (CF/G), which characterizes the errors of deaf-sound substitutions, since this group is different from the others. The same occurs with the errors of segment order change (AOS), showing another common feature of students with dyslexia (GI), as their operational memory deficit causes them to change the order of letters while writing words.

On the other hand, the students with good academic performance (GIII) differentiated from the other groups by showing greater mastery and knowledge of the orthographic rules of Brazilian Portuguese.

Discussion

It is valuable to note the importance of phonological processes during the acquisition of writing in students with dyslexia, since they present alterations in phonological processing skills, causing deficits in the organization and elaboration of grammatical forms, difficulties in phonological operational memory, and orthographic errors (BUENO *et al.*, 2017; CASSIDY *et al.*, 2017; PASCHOAL *et al.*, 2014; PESTUN *et al.*, 2010; SAMPAIO *et al.*, 2017).

Since phonological organization is the basis for speech development, students can reflect on the sound system of language, identifying phonemes that make up the word and developing knowledge about the writing principle of the alphabetic system.

Going against the literature, this study showed that children with dyslexia had a higher number of natural spelling errors in both dictations due to phonological organization deficits, leading them to make segment order alteration errors, segment omission and addition, and univocal phonographic conversion errors, that is, the substitution of [p] for [b], [t] for [d], [f] for [v] and other substitutions that may be named as deaf-sounding. In students with good academic performance and learning disabilities, natural spelling errors are smaller, as they do not have deficits in their phonological organization.

During the acquisition of writing, it is expected that spelling errors will decrease as school years advance. Schoolchildren who do not succeed in appropriating writing since the early school years are at risk for learning problems. However, since spelling follows conventionally established standards, it is necessary that there is formal teaching of spelling to schoolchildren, because when this does not occur, doubts about writing multiply and their writing may be lagging, leading the reader to think about learning problems (CAPELLINI *et al.*, 2011; MEIRELES; CORREA, 2006; MORAIS, 1999; OLIVEIRA; GERMANO; CAPELLINI, 2016).

In this research, the schoolchildren considered to have learning disabilities may have performed similarly to schoolchildren with dyslexia due to the lack of formal spelling instruction in schools and the fact that spelling is worked on from 3rd to the end of 5th grade (BNCC, 2018), so not all schoolchildren have undergone systematic learning of all spelling.

In view of all the discussions brought here, it is possible to conclude that this study showed that the Pseudoword Dictation test is the one that brings the different characteristics of the orthographic writing of students with dyslexia when compared to the other groups, showing their differentiation from the others in the tests of univocal phonographeme correspondence (CF/G) and change in segment order (AOS).

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