

Morphological Awareness in Brazilian Learners with Developmental Dyslexia

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Abstract

There is consistent empirical support that demonstrates the relationship between phonological deficits of developmental dyslexics and their reading difficulties. However, the morphological skills—which also play an important role in the development of alphabetic writing—are seldom investigated among children and adolescents with dyslexia. The focus of this study was to analyse reading patterns according to the dual route model and verify the performance of each subtype of dyslexic in tests of morphological awareness. Participants were nine students classified as surface or phonological dyslexics through their performance in an isolated words-reading task. Four tests were applied to the participants to assess their knowledge of derivational morphology, and two tests focused on their knowledge of inflectional morphology. The hypothesis that guided this research was that students with different reading patterns would also present different performances on morphological tests. This hypothesis was confirmed only for derivational morphology, in which a higher performance was observed among participants with phonological dyslexia. It is concluded that metamorphological skills may serve as facilitators of reading in students with developmental dyslexia, and a focus on the development of these skills is suggested as a strategy to promote the reading skills of these students.

Keywords

Reading, Developmental Dyslexia, Morphological Awareness

1. Introduction

Despite the prominent studies focused on phonological awareness in students with developmental dyslexia

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(Alexander, Andersen, Heilman, Voeller, & Torgesen, 1991; Blomert & Willems, 2010; Bruck & Treiman, 1990; Castles & Coltheart, 2004; Kovelman et al., 2012; Schulte-Körne, Deimel, Bartling, & Remschmidt, 1999; Snowling, 1987, 1995; Swan & Goswami, 1997; Thomson & Goswami, 2010), little research has investigated the relationship between morphological awareness and reading among these students. In 1996, Elbro and Arnback presented studies that indicated that dyslexic teenagers used the metamorphological skills as a compensatory reading strategy, and that, regardless of phonemic awareness, the training in morphological consciousness might have positive effects on reading and spelling of words that were morphologically complex.

The relationship between the morphological awareness and reading performance of learners with dyslexia is due to the fact that spelling is not entirely predictable from phonemes. This is true for irregular spellings, such as English, and to some extent, French and Portuguese. These spellings are not fully transparent at the grapheme-phoneme level because they are regulated not only phonologically, but also morphologically (even on Portuguese, whose spelling is phonologically more consistent than in English).

To analyze the possible influence of morphological skills in reading and writing (spelling) ability, it is important to highlight that morphology refers to the patterns of word construction based on morphemes, which in turn can be defined as the smallest units of meaning in a language. Morphemes may be a whole word (for example, the noun “ball”) or a portion of the word which carries meaning (e.g. the “s” in the word balls, meaning *more than one*).

According to Laroca (2005), linguists identify two main classes of morphemes, this is, the roots (minimum nucleus of a morphological construction) and affixes (prefixes when added before the root, and suffix when added after the root). Note also that morphology is divided into two branches: the *inflectional* and *derivational morphology*. Derivational morphology studies the structure and processes of word construction. For example, in the pairs *make/remake*, or *make/unmake*, the original meaning of the word “make” was modified by prefixes “re” or “un”, generating words with different meanings in the language. On the other hand, inflectional morphemes are always suffixes added to words in order to fit those in the syntactic context in which they operate. Thus, they can be added to substantives and adjectives to modulate gender and number, and to verbs to inflect them in terms of mode and time, and also number and person.

It is worth pointing out that the distinction of different types of morphemes is important, since the development of the processing of inflectional morphology and derivational may be different. According to Deacon & Bryant (2005), it is easier to understand the relationships in inflectional morphemes than in derivational morphemes, mainly because inflectional morphemes do not change the grammatical class of the word, while the opposite can happen when using derivational morphemes.

There are several studies that have investigated the role of morphological awareness on the capacity to recognize words in people with developmental dyslexia. Most of them developed in Canada, United States and United Kingdom and mostly focused on the use of English (Arnback & Elbro, 2000; Bourassa & Treiman, 2008; Bourassa, Treiman & Kessler, 2006; Carlisle, 1987; Elbro & Arnback, 1996; Joanisse, Manis, Keating, & Seidenberg, 2000; Tsesmeli & Seymour, 2006). There were also a few studies carried out focused on French (Casalis, Cole, & Sopo, 2004) and Portuguese (Ferrari Neto & Sousa, 2012).

One of the authors who was among the most dedicated to investigating the linkages between morphological consciousness and the process of learning a written language was Carlisle (1988, 1995, 1996, 2000), especially in studies conducted among children with typical development of reading and writing. With regard to children with learning difficulties, Carlisle (1987) conducted a study based on the premise that knowledge of rules of derivational morphology is related to the spelling skills of normal students and also those with learning-disabilities (LD). The study addressed three questions: 1) comparison between LD students and normal students in the learning of derivational morphology and the spelling of derived words; 2) whether students with LD learn derived forms according to rules; 3) how much each type of student (LD and normal) uses the knowledge of the relationships between its derived words and its base to spell derived words (e.g. “magic” and “magician”). The study involved 17 students of ninth graders enrolled in a rural school that served students with learning disabilities and a control group composed of 22 fourth graders, 22 sixth graders and 21 eighth graders, of typical development. The results showed that the level of knowledge of derivational morphology of LD students (ninth grade) was intermediate between the normal students of sixth and eighth grade. In addition, students with LD were similar to the domain of normal students in sixth and eighth year of phonological and orthographic rules, but their spelling of derived forms was equivalent to what was found among fourth graders. The author concludes that the LD students know more about the derivational morphology they use than of spelling. Besides,

they were significantly more likely to spell derived words to the whole words, without regard for morphemic structure, even when compared to fourth graders. However, most spelling mistakes made by LD students were phonetically acceptable, suggesting that these errors cannot be attributed to the lack of knowledge of grapheme-phoneme correspondence.

In subsequent work, [Elbro & Arnback \(1996\)](#) presented research discussing how morphological skills can influence the reading performance of students with dyslexia. The authors suggest that dyslexic teenagers can use their knowledge of morphemes (in this case knowledge about the roots of the word) as strategies for word reading and text comprehension. In one of the presented studies, participants (students with dyslexia and students in the control group) were asked to read words with semantically transparent morphological structure (e.g. sunburn) and words in which the morphological structure was not semantically transparent (e.g. window). It is relevant to note that the words presented were matched for length (between 4 and 8 letters), consonant-vowel structure, word class, frequency of occurrence and concreteness. The study results indicated that the reading performance from dyslexic adolescents was significantly affected by the morphological structure of words (words with a semantically opaque morphological structure were more demanding in reading than those with transparent structures), in comparison to the performance of the students in the control group, with normative reading levels. Moreover, a positive correlation between morphological dependence on the performance in reading and reading comprehension was found among dyslexics, which means that dyslexics who made use of morphological analysis in reading showed the best results in reading. This correlation was not found between the students in the control group, which led the authors to suggest that a morphological analysis is a compensatory strategy developed by dyslexics because of their difficulties in phonological recoding.

In view of this results, [Arnback & Elbro \(2000\)](#) hypothesized that it would be useful to experiment on supporting the development of fluent reading in cases of dyslexia through teaching the recognition of morphemes as a reading strategy. To test this hypothesis they conducted an intervention study aimed at developing morphological awareness in students with dyslexia. Study participants were 50 students (33 experimental and 27 control group), who underwent a training program divided into three parts. The first part compound exercises were developed (transparent and opaque compounds/metaphorical), the second part of the training focused on derivational affixes (prefixes and suffixes) and, in the latter part inflections were discussed (nouns, verbs and adjectives). The analysis of results showed no difference between groups in decoding, for both real and pseudowords¹. However, the experimental group showed a significant improvement in reading comprehension. According to [Arnback & Elbro \(2000\)](#), the improvement in the understanding displayed by students who participated in the training program in morphological awareness may be due to a greater focus on the meaning of morphemes while reading.

[Bourassa et al. \(2006\)](#) conducted a study focused on examining how kids with dyslexia and younger children with typical reading development used their morphological skills as an aid to reading and spelling. The experiment evaluated how children dealt with situations in which a small word (e.g. drive) was used to clarify the spelling of derived words such as *driving* and *driver*. The results showed that the spelling produced by children with dyslexia are similar to those of the younger children of the same reading level, i.e., both the younger children in the control group as well as children with dyslexia showed difficulty in taking advantage of derivational morphology to improve spelling, or to make a correct identification in reading. Finally, the study found that both groups of children benefited from morphology in some way, but not as much as they could.

The exploratory study conducted by [Tsesmeli & Seymour \(2006\)](#) evaluated the association between spelling (ability to read and write) words derived from impoverished and/or morphological vocabulary knowledge in teenagers with dyslexia. To identify differences in spelling, vocabulary and derivational morphology was evaluated among three groups of participants: the 1st was composed by students with dyslexia was 13 years or older, the 2nd group was composed of students with dyslexia of the same age, while the 3rd group included students with the same reading level of those students with dyslexia, and cross-sectional tests with degree variations were applied. Results showed a deficit in spelling in students with dyslexia compared to both control groups, and that was not associated with poor vocabulary, a finding verified in comparison with students of the same age. Moreover, the group of students with dyslexia showed equivalent level of morphological knowledge when compared with the of the control group with similar reading level, and lower levels of morphological knowledge when compared with students in the control group of the same age. These results confirm the existence of a reciprocal relationship between the development of morphological awareness and spelling ability.

To investigate how English speaking children with dyslexia used the root morphemes as an asset in reading

morphologically complex words, Bourassa & Treiman (2008) conducted a research in which 32 participants with dyslexia were shown two lists of 28 morphologically complex words, totaling 56 words. The control group had the same number of participants of younger age, but in the same level of reading and spelling from those of in the group of participants with dyslexia. The first list contained words spelled similarly but with different pronunciation, such as the words *drama* and *dramatic*, in which the second/a/has a different pronunciation. The second list included complex words spelled differently from their basic form, reflecting a change in pronunciation, such as the words *anger* and *angry*. According to the study results, children with dyslexia obtained similar results in comparison to the children with the same reading level in the control group, this is, both groups exhibited difficulties in linguistic structures such as consonant clusters or flaps. Moreover, in both groups it was identified the use of the principle of morphological constancy² in words where it would not be applicable, which shows that the strategies used by children with dyslexia are similar to those of children with typical reading development also in their mistakes. However, these findings confirm that dyslexics are slower to learn the spelling than other children and may not reach the performance expected for their age.

Similarly to the previous study (Bourassa & Treiman, 2008), the work by Ferrari Neto & Sousa (2012) conducted among speakers of Brazilian Portuguese also examined the processing of morphologically complex words in children with and without dyslexia. The study investigated the acquisition of derivational morphology in 4 groups of children: the first group was composed by 15 children without dyslexia aged 86 months (7 years); group 2 by 8 dyslexic children with the same age of those in group 1; group 3 had 10 children without dyslexia aged 109 months (9 years); and group 4 had 8 children of the same age as group 3, but with dyslexia. Three lists of 12 words were created for the study, including 4 prefixed, 4 suffixed and 4 with the same root. These lists also had 12 mono-morphemic distracting words. The test was administered via computer, recording the response time after an initial training for the child to practice in the test environment before starting. As a result, Ferreira Neto and Sousa (2012) found that in both age groups, children with dyslexia showed slower decoding, understanding and comprehension in the processing of words that were read and heard.

It is relevant to emphasize that the studies presented here examining morphological consciousness among people with developmental dyslexia do not mention the differences in reading patterns between the group of people with dyslexia, this is, these studies do not highlight the multifaceted nature of this learning disorder. However, there is a long tradition of research (Castles & Coltheart, 1993; Coltheart, Masterson, Byng, Prior, & Riddoch, 1983; Coltheart 1996; Ellis, 1995; Manis, Seidenberg, Doi, McBride-Chang, & Petersen, 1996) identifying at least two subtypes of developmental dyslexia: phonological dyslexia and surface dyslexia. In addition to the cited authors, a study by Peterson, Pennington, & Olson (2013) describes six studies aimed at investigating phonological and surface dyslexia in the light of computational models of word reading: the double-route cascaded model and the connectionist model. The work of Peterson, Pennington, & Olson (2013) converges with results from earlier studies investigating dyslexia, showing that the dual-route models provide an explanation for the different patterns of reading in developmental dyslexia. Thus, this work confirms the studies of Coltheart et al. (1983), Ellis (1995) and Coltheart (1996, 2005), showing that in phonological dyslexia reading is performed through the lexical route (direct) while in surface dyslexia reading is mainly processed through the phonological route (sublexical or indirect).

The lexical route is used when the item is represented in the visual lexicon of the reader and therefore is recognized as a word. On the other hand, reading the phonological route (sublexical) occurs when the reader does not recognize the item as a word and performs reading through the conversion of orthographic segments (i.e. simple graphemes, compounds and sequences of letters) into phonological segments. After this conversion, the phonological units are combined to form a phonological whole and, if access to its meaning occurs, it is obtained through the mediation of the auditory form of the word (Coltheart, 2005, Dehaene, 2012, Ellis, 1995, Guimarães, 2004).

However, it is emphasized that, in general, during the process of reading through these pathways—lexical and sublexical—“coexist and complement each other” (Dehaene 2012: p. 53). In other words, access to lexical and sublexical routes occurs simultaneously. Thus, when faced with the visual stimulus, the routes converge and flow simultaneously in a phonemic system (Coltheart, 2005).

In the case of the adolescent with phonological dyslexia investigated by Temple & Marshall (1983), the reading mistakes were especially of two types: visual and derivational. In the first case, the words that were read derived from those presented to the participant. For example, the participant read “*height*” instead of “*high*”, “*smoldering*” instead of “*smoulder*”, “*appearance*” instead of “*appeared*”, and others. Moreover, she has made

mistakes that were pseudo-derivational, reading, for example, “*injust*” instead of “*unjust*”, “*conscient*” instead of “*conscience*”. In the case of the mistakes of the visual type, the adolescent read words that were visually similar to the words presented as stimulus (e.g. “*archive*” instead of “*attractive*”, “*cherry*” instead of “*cheery*”, “*hushed*” instead of “*harsh*”, and others). Therefore, along with Ellis (1995) and Coltheart (1996) it is possible to characterize the phonological dyslexia as a difficulty reading aloud unfamiliar words and pseudo words compared to reading familiar and regular words. This is a selective limitation to reading unfamiliar words or pseudo-words, in which the individual does not show great difficulty in the procedure of lexical reading.

As already mentioned, people with surface dyslexia demonstrate use more sublexical routes in reading aloud, decomposing and grouping the letters, relating phonemes with graphemes and reading the result of this process. However, have difficulty reading aloud orthographically irregular words high because they use the sublexical route, they make mistakes “regularization”, so pronounce the words as if they were regular. In the study by Coltheart & collaborators (1983), two cases of surface dyslexia were analyzed, one acquired from dyslexia and other from developmental dyslexia, both of which showed¹ quite similar reading patterns. So, the girl with developmental dyslexia at age 17 performed better in reading aloud regular words than irregular words and, often, when irregular words were misread the incorrect word were its regularization (“*beer*” instead of “*bear*” and “*gorge*” instead of “*gauge*”).

To identify the occurrence of the two subtypes of developmental dyslexia, Manis et al. (1996) conducted a study using methods developed by Castles & Coltheart (1993). They investigated three groups of children: 51 with dyslexia, 51 typical readers matched to the group of participants with dyslexia according to chronological age and 27 typical readers younger than those with dyslexia, but who were in the same reading age of participants with dyslexia. The authors identified two subgroups who met the criteria for phonological and surface dyslexia. Participants with surface dyslexia showed lower performance in reading irregular words in comparison to nonwords, while an opposite pattern was identified among children with phonological dyslexia. However, the performance of most dyslexic was lower in reading nonwords and irregular words when compared to younger typical readers who were in a similar reading level. The authors noted that the performance of children with surface dyslexia was similar to the younger with the same reading level children, but the performance of the group with phonological dyslexia remained lower. Furthermore, the study showed that in a task that involved orthographic knowledge, surface dyslexics had difficulty, but this was not the case in the task involving phonology. The group of phonological dyslexics showed a contrasting pattern, with difficulties in phonological tasks and better performance in the task of orthographic knowledge. Finally, data from this study can be taken as evidence for the dual-route model, supporting the conclusion that there are at least two distinct subtypes of developmental dyslexia.

Another study that analyzed morphological skills among participants with different subtypes of dyslexia was conducted by Joanisse et al. (2000). This study investigated the relationship between dyslexia and three aspects of language: speech perception, phonology and morphology. Reading and language tasks were given to dyslexics aged 8 and 9 years, and two groups of normal readers (52 children with the same age of the group of participants with dyslexia and 37 younger children at the same reading level of those with dyslexia). According to the results, three groups of dyslexics were identified: phonological dyslexics (PD), dyslexics with delayed language development-language developmentally impaired (LI), and the third with a global delay-delay-type dyslexics. The LI and PD groups exhibited similar reading patterns, which could be attributed to low phonological skills. However, the LI group showed clear speech perception deficits, suggesting that these deficits affect a specific subtype of dyslexics. It is noteworthy that the results also showed phonological impairments in children whose perception was normal. In regard to morphology, both the LI group and PD showed difficulties in inflectional morphology, with the most severe impairment in the LI group. Reading and language skills in the delay-type subgroup were very similar to what was observed in younger readers in the same reading level, suggesting that these dyslexics had a few delay in reading and language skills, rather than a specific phonological deficit. Based on these results, Joanisse et al. (2000) hypothesize that the difficulties to analyze the phonological structure of language presented by dyslexics can also affect their ability to analyze the morphological structure.

Another study involving this same theme, but in the French language, was conducted by Casalis et al. (2004) aimed to analyze in detail how phonological disabilities in dyslexia affect the use of larger units of language,

¹According to Bourassa & Treiman (2008, 2014) the principle of morphological constancy is related to the fact that the writing of an English morpheme remains the same, even when it changes the pronunciation. For example, the word *heal* maintains its spelling in a morphologically complex form, such as *health*.

such as morphemes. To this end two studies were conducted, the first comparing the performance on morphological tasks of 33 dyslexic children, 33 children of the same age and 33 children with the same reading level (reading-age). The performance of children with dyslexia in all of the tests was lower than those in the same age group, suggesting that morphological consciousness cannot be fully developed independently from reading experiences and/or phonological skills. Comparisons with same group of similar reading level indicated that although dyslexic children had performed worse in the segmentation of morphemes, they performed the task of completing sentences according to their reading level. Furthermore, in the production task they produced more derived words. This suggests that phonological deficits impede explicit segmentation of affixes, allowing the development of the productive morphological knowledge.

The second study reported by Casalis et al. (2004) investigated the morphological consciousness in two subgroups of dyslexics: 11 with phonological dyslexia (PD) and 14 delayed dyslexic (DD). The authors argue that dyslexic children have a special profile of morphological skills, regardless of the type/subgroup of dyslexics, they develop their morphological skills, at least in part, independently from phonological skills. Thus, their results corroborate Elbro & Arnback (1996) showing that, in fact, dyslexics develop compensatory reading strategies.

The studies of Joanisse et al. (2000) and Casalis et al. (2004) discussed the morphological skills in people with different subtypes of developmental dyslexia, especially in phonological dyslexics (PD) and delayed dyslexics (DD). However, it appears that, like many other studies presented here, they are much more suggestive than conclusive. Thus, investigating the role of morphological consciousness in improving reading and also writing among children and adolescents with developmental dyslexia is shown as an important and necessary research agenda in the various alphabetic languages. It is in this context that this study is proposed, with the purpose of identifying the reading procedure used preferentially by participants (participants with reading patterns of phonological and surface dyslexia), examining a possible relation between reading patterns and performance on tasks assessing morphological awareness (inflectional and derivational). In principle, it was hypothesized that the performance of participants on tasks assessing morphological awareness (tasks of derivational and inflectional morphology) would be associated with its reading pattern.

2. Methods

2.1. Participants

The research universe was composed by students who received a diagnosis (report) of dyslexia performed in the eight Municipal Centers for Specialized Care (CMAEs), within the Network of Municipal Schools of Curitiba, Southern Brazil. Among the 41 students diagnosed with dyslexia registered and treated in CMAEs, it was decided to perform the tests with the students who attended two CMAEs selected according to the convenience of access by the researchers. Contact with participants occurred through the Coordination of Special Needs Services (CANE) of the Municipal Secretariat of Education in Curitiba, and in the sequence the Terms of Informed Consent was presented and signed by parents or guardians. Thus, from the referred universe, nine students were selected as research participants. In the beginning of the study participants were aged between 9 years and 7 months through 12 years and 7 months, and attended 4th, 5th and 6th school grades and none of them presented any reported sensory or emotional problem.

2.2. Instruments

This study was based on two types of instruments for data collection:

2.2.1. Isolated Words Reading Task (Real and Invented Words)

In order to identify the reading pattern of student two lists of words were organized (A and B), selected from the list of words presented by Pinheiro (1994), one in capital letters and one lowercase (script form) containing real and invented words. Each list contained 18 real words and 09 invented words, totaling 27 words organized as follows: 03 high frequency regular words; 03 low frequency regular words; 03 high frequency rule-words; 03 low frequency rule-words; 03 high-frequency irregular words; 03 low frequency irregular words; 09 invented words (the words in the list were created from changes in one or two letters of the actual high frequency words from list B and vice-versa).

2.2.2. Evaluation of Morphological Awareness Tasks

In order to evaluate morphological consciousness, six tests were applied, all of which had already been used in previous studies (Guimarães, 2005; Paula, 2007; Barbosa, 2013). It is noteworthy that the first two tests described (2.1—inflectional graph-morphological and 2.2—derivational graph-morphology) were adapted for this study. Specifically, some items were changed and, unlike Paula (2007), we asked participants to mark the word that was equal to the keyword shown, and not the intruding word. These two tests were presented in printed form, while the four remaining tests assessing morphological consciousness were applied orally.

Inflectional graph-morphology task: Developed by Paula and Besse (Paula, 2007), this task considers the inflection of nouns (gender variance) and verbs (verb tenses). Altogether the task presents 15 items (three for practice and 12 experimental): six with *gender* inflection and six with verb *tense* inflection—three past/future and three present/past.

To perform the test participants had to find which word, with two options, was similar to the keyword that was shown, as in the example below:

Example 1: What is the word used only for women—“esposa” (keyword): “carioca” (a person from Rio de Janeiro) or “garota”? In this case the answer is “garota”.

Example 2: What is the word that indicates a past action, such as “trabalhei” (keyword), “andarei” or “achei”? In this case the answer is “achei”.

Example 3: What is the word that indicates an action like “celebram” (keyword), “respiram” or “mandaram”? In this case the answer is “respiram”.

Derivational graphic-morphological task: Developed by Paula and Besse (Paula, 2007), in this task the participant has to decide whether a word is constructed in the same way as another, from the explanation of how we can get new words by adding a *prefix* or *suffix* on a *primitive* word. For example: the word “descobrir” comes from “cobrir”. The same situation occurs with “desfazer” and “fazer”, in which “des” is added to the beginning of “fazer”. However, for the student to discriminate a derived word from another word that is not derived, the word “universo” could be presented as an example that has the syllable “uni” in front, but not from “inverso”.

After the explanation participants complete, with the support of the researcher, the four training items (two involving prefixes and two involving suffixes) and should find which among two words has a morphological structure that is similar to the presented keyword. The task consists of six groups of three words involving prefixes (example: unclear-universe-unwilling) and six groups of three words involving suffixes (example: comfortable-enjoyable-stable).

Morphological analogies task (Guimarães, 2005): This task was assembled according to the scheme traditionally used in analogy tasks, i.e., “A” is for “B” as “C” is for “D”. It was applied orally to the participants, and to answer the students should use the root of “C” and generate a word of the same grammatical category as “B”. The task consisted of 12 items (two for practice and 10 experimental). It is noteworthy that in the preparation of the pairs (“B” and “D”) words were selected that did not rhyme; this procedure was to avoid possible phonological interference in the performance of the task. This task was administered orally to the children. The items used in training are presented as an example:

Example 1: A – bondade B – bom C – maldade D – _____.

Example 2: A – Europa B – europeu C – África D – _____.

Test of derivation in context (Barbosa, 2013): This test consists on providing base words which should be used to generate derived words to complete the presented sentences.

Is emphasized that, in the 16 items of the test, the relation between base words and derived words is as follows:

substantive → substantive, suffixes required: -ada; eiro-(items 1, 2, 9 and 10);

adjective → substantive, suffixes required: -dão; -dade ou -eza (items 3, 4, 11 and 12);

verb → substantive, suffixes required: -nte; -dor (items 5, 6, 13 and 14);

substantive → adjective, suffixes required: -ânea; -oso (items 7, 8, 15 and 16).

The items used in training are presented as an example:

a. (jornal) – Eu preciso esperar pelo _____. (jornaleiro)

b. (cruel) – O bandido agiu com _____. (crueldade)

c. (momento) – O país se recuperou, foi uma crise _____. (momentânea)

Test of morphological decomposition (Barbosa, 2013): This test consists in supplying derived words to be transformed into base words, by removing their suffixes. The base words should complete the sentences pre-

sented. In the 18 items in the task the relations between base and derived words is as follows:

- substantive → substantive, suffixes to be suppressed: -eiro; -eira; -ada; -zal (items 1, 5, 9 and 13);
- substantive → adjective, suffixes to be suppressed: -dade; -eza; idão (items 4, 8, 12, and 16);
- substantive → verb, suffixes to be suppressed: -nte; -dor (items 3, 7, 11 and 15);
- adjective → substantive, suffixes to be suppressed: -ado; -oso (items 2, 6, 10 and 14).

The items used in training are presented as an example:

- a. (horroroso)- Aquele filme foi um _____. (horror)
- b. (corredor)- Quanto rápido ela pode _____. (correr)
- c. (boiada)- Preciso evitar comer carne de _____. (boi)

Task of flexing in context (Barbosa, 2013): This test discusses the flexing of substantives (number, gender and grade) in items 1, 5, 9, 13; flexing of adjectives (gender, number and grade) in items 3, 7, 11 and 15; and flexing of verbs (number, person, tense and mood) in items 2, 4, 6, 8, 10, 12, 14 and 16.

Similarly to the two tests described previously, in this task a word is presented to the student who must then place it in the context of a sentence (flexing it or not as required by the context).

The items used in training are presented as an example:

- a. (pintor). Carla adora brincar com pincéis e tintas, quando crescer ela quer ser _____.
- b. (triste). Depois de perder o jogo, os meninos ficaram com os olhos _____.
- c. (participar). Ontem teve uma gincana no parque e todas as crianças _____.

3. Procedures

This study was submitted to the Ethics Review Board of the Federal University of Paraná, Department of Health Sciences, obtaining a favourable review, and it was registered in the CEP/SD: 1224.149.11.09 CAAE: 0146.0.091.000-11, in accordance to the Resolution CNS 196/96. It is emphasized that in order to safeguard the identity of participants, in this article they are referred through the use of the initials of their names.

The application of the study tasks occurred in private rooms made available in each of the regional centers where participants receive specialized care. Participants were assessed individually. The application of the instruments took three to four sessions of 20 to 30 minutes, with no time limit for completing the tasks, and the first two sessions were always initiated with the reading of isolated words.

4. Results

As the mean score could vary according the scale of each test, the score obtained by participants was transformed into percentage, in order to obtain a standardized result across tests and to facilitate comparisons across tests.

4.1. The Reading Test of Isolated Words

Table 1 shows the results of isolated words reading (low frequency, high frequency and invented) The results show that the nine participants performed better in reading high-frequency words compared to the performance in reading low-frequency and invented words. These results suggest that, in reading these words, participants preferentially used the lexical route, characteristic of the reading pattern of phonological dyslexia.

However, it is known that some readers who present difficulties for reading through the phonological route (sublexical) present even greater difficulties in using the lexical route, (such as those with the reading pattern of surface dyslexia, who perform reading through the grapheme-phoneme conversion). In order to identify participants with this profile (reading pattern of surface dyslexia), **Table 2** presents the scores on the reading of regular, rule, irregular and invented words.

In **Table 2**, two students (BPT and PHL) present better than average scores in reading invented, with slightly higher scores in comparison to the other participants. Moreover, they present superior performance in reading regular words in comparison to their reading of irregular words. These results suggest that these two students use preferably the sublexical route, the characteristic reading pattern used by individuals with surface dyslexia.

From the analysis of the results presented in **Table 1** and **Table 2**, it is possible to state that seven participants (AOJ, ACC, CXF, GSC, GMS, RDS, TXG) present reading patterns of phonological dyslexia (preferential use of the lexical route), while two participants (BPT, PHL) present surface dyslexia reading patterns (preferential

Table 1. Number and percentage of words of high frequency, low frequency and invented read correctly per participant.

Students	High frequency (18 words)		Low frequency (18 words)		Invented (18 words)		Total (54 words)	
	N	%	N	%	N	%	N	%
AOJ	17	94.4	13	72.2	11	61.1	41	75.9
ACC	18	100	12	66.7	11	61.1	41	75.9
BPT	18	100	12	66.7	13	72.2	43	79.7
CXF	17	94.4	13	72.2	11	61.1	41	75.9
GSC	15	83.3	11	61.1	12	66.7	38	70.3
GMS	16	88.9	12	66.7	10	55.6	38	70.3
PHL	17	94.4	11	61.1	15	88.3	43	79.7
RDS	13	72.2	10	55.6	10	55.6	33	61.1
TXG	17	94.4	10	55.6	08	44.4	35	64.9

Table 2. Number and percentage of real (regular, irregular and rule) and invented words read correctly per participant.

Students	Real words						Invented words (18 words)	
	Regular (12 words)		Rule (12 words)		Irregular (12 words)		N	%
	N	%	N	%	N	%		
AOJ	10	83.3	12	100	08	66.7	11	61.1
ACC	12	100	09	75	09	75	11	61.1
BPT	11	91.7	10	83.3	09	75	13	72.2
CXF	10	83.3	10	83.3	10	83.3	11	61.1
GSC	09	75	09	75	08	66.7	12	66.6
GMS	10	83.3	10	83.3	08	66.7	10	55.5
PHL	11	91.7	08	66.7	09	75	15	83.3
RDS	10	83.3	07	58.3	06	50	10	55.5
TXG	09	75	09	75	09	75	08	44.4

use of sublexical route). It is noted, however, that caution must be exercised when considering the results that will be presented as representative of student performance with two different reading patterns (phonological dyslexia and surface dyslexia), in view of the small sample size.

4.2. Morphological Consciousness

Table 3 summarizes the results of the six tests of morphological consciousness, as well as the mean for correct answers on the evidence concerning derivational morphology (graph-morphological derivational, morphological analogies, derivation in context, morphological decomposition) and flexional morphology (graph-morphological flexional, contextual flexion), besides an overall score of morphological consciousness obtained from the average of correct answers in the six tests.

When focusing on the performance of participants in the tests of derivational morphology, it appears that regardless of the reading pattern of participants, they showed the lowest performance in the graph-morphological derivational task, and obtained their best results in morphological decomposition. In the latter task a slightly better performance is observed among students with a reading pattern of phonological dyslexia.

Table 3. Percentage of correct answers in the six tests of morphological consciousness, mean score for correct answers in tests of derivational morphology, flexional morphology and the global score of morphological consciousness, per participant.

Students	Derivational morphology				Inflectional morphology				Global score
	Grafo deriv.	Morphological analogies	Deriv. in context	Decomp. morph.	Mean deriv. morph.	Inflectional graph-morphology	In context flexion	Mean inflect. morph.	
AOJ	58.3	60	87.6	100	76.4	58.3	87.6	73	74.7
ACC	66.7	60	62.6	81.2	67.7	75	81.2	78.1	72.9
CXF	58.3	60	56.2	81.2	64	66.7	56.2	61.4	62.7
GSC	58.3	70	62.6	75	66.4	25	43.8	34.4	50.4
GMS	41.7	50	62.6	81.2	58.9	41.7	62.6	52.1	55.5
RDS	41.7	80	56.2	75	63.2	83.3	75	79.1	71.1
TXG	41.7	50	62.6	81.2	58.9	75	56.2	65.7	62.3
BPT	50	30	68.8	75	56	50	62.6	56.3	56.1
PHL	50	20	56.2	68.8	48.8	83.3	75	79.1	63.9

In the task of derivation in context, students from both reading patterns had a regular performance, all above 50%, but in average they did not show an exceptional performance in this test—except for AOJ, whose percentage of correct scores was 87.6%. In regard to the morphological analogies task, participants showed an expressive difference in performance, i.e., all students with phonological dyslexia reading patterns were correct in 50% or more of the cases, while the two students with surface dyslexia reading pattern showed a performance were 30% and 20%.

On another hand, participants' performance on tests of flexional morphology show that, in both tests, a very heterogeneous performance was observed, although not expressively high or low, except for the participant GSC, who responded correctly only 25% of the flexional graph-morphological task. However, what draws attention on the results of this task is the large difference in performance among students with the reading patterns of phonological dyslexia, with results within this group ranging from 25.0 points (SSC) through 83.3 points (GSC), in a total difference of 58.3 between these scores.

Finally, considering the mean performance in the two types of morphology tasks, there was an expressive difference between students in derivational morphology, i.e., the mean of students with reading patterns of phonological dyslexia are expressively higher than those of students with surface dyslexia. On another hand, the same is not true in regard to the tasks focused on flexional morphology, since it was not possible to identify a trend from which differences related to reading pattern could be inferred from the results of this task.

5. Discussion

There is considerable theoretical and empirical support for the hypothesis that, in addition to phonological consciousness, morphological consciousness may also be a skill that facilitates performance in reading (decoding and comprehension) for those with developmental dyslexia. However, there is still little investigation about the morphological consciousness and the relation between this skill and the reading performance in people with different subtypes of dyslexia. Thus, it was hypothesized that the performance of participants in morphological consciousness evaluation tasks (tasks of derivational and flexional morphology) was related to reading patterns.

The analysis of the performance of participants suggested that this hypothesis was partially confirmed, considering that students with phonological dyslexia reading patterns performed better than those with surface dyslexia reading patterns, but only in tasks of derivational morphology. The tasks evaluating the skills related to flexional morphology showed no significant differences between the performance of participants with reading patterns of phonological and surface dyslexia.

Elbro & Anbark (1996) affirm that the recognition of morphemes can help dyslexics to compensate their phonological difficulties and serve as facilitator of reading. The results of the current study suggest that the skills

related to derivational morphology in particular enable such facilitation. However, it is not possible to infer what this relation means and whether this skill is a predecessor or a consequence of the learning of the written language by these students. It is likely that morphological consciousness and the learning of a written language develop in interaction, as suggested by the results of the study by Tsesmeli & Seymour (2006). Thus, the initial morphological skills contributed to the acquisition of reading of these students; likewise, experiences with written language enabled the development of more complex morphological consciousness skills.

In regard to the role played by skills related to derivational morphology in facilitating reading, it is suggested that students with reading patterns of phonological dyslexia do not read only through lexical routes, in other words, reading whole words, but as suggested by Murrell & Morton (1974), morphemes are graphemic schemes that can be processed as a unit. Thus, the learning of keywords containing such segments that can be roots/radicals (e.g. “ferr-”—the primitive root word “ferro” and the derived “ferrolho”, “ferroar”, “ferrugem”, and “ferrovia”) or affixes (e.g. “-dor”, “-ista”, “-mento”, “-ção”, “-inho/-zinho”, “in-”, and “re-”) generates word sets. Moreover, it is argued that it is the semantic aspect of morphemes that enables reading comprehension, an issue that is not investigated in this study.

Thus, if the recognition of written morphemes can compensate the phonological difficulties experienced by dyslexics, as suggested by Elbro & Arnbak (1996), it may be helpful to teach morpheme recognition as a reading strategy to support the development of fluent reading among students with reading patterns of dyslexia (especially in cases of phonological dyslexia patterns). However, given the derivational aspect of the reading errors among people with phonological dyslexia (Temple & Marshall, 1983), it is important that they receive explicit teaching of morphosyntactic contents so that they can read words more accurately in the context of sentences by predicting the grammatical class of the words that fits the text being read, as suggested by Rego & Bryant (1993).

From another part, with regard to the performance, flexional morphology of the participants confirms the hypothesis of performance difference according to the reading standard, considering that there is no big difference in performance among the participants. The data obtained in this study show that, in general, all participants have an average performance (except GSC—students with reading standard of phonological dyslexia—which underperforms² 50% in both tasks). Besides, comparing the performance of participants in both types of tests, it is clear that its performance is not significantly higher in one of the types of tests (for derivational morphology or flexional morphology). This is an unexpected result, since according to Deacon & Bryant (2005) it is easier to understand the relationships in morphemic inflections than in leads. One possible explanation for the low performance of the participants in these competitions, especially in the proof of flexion in context, is that linguistic variant can be used by the research participants, which may have caused errors like what has happened to complete the following sentence “Ontem teve uma gincana no parque e todas as crianças _____”, which is completed by students with the word “participaro” (sic). In this respect, it indicates that the need for this variable in other studies (linguistic variant) is controlled.

However, we must clarify that the data presented here must be carefully analyzed, given the limitations that permeate this kind of study. The first concerns the small number of participants investigated, especially students with reading standard of surface dyslexia, only two students. The second problem relates to the difficulty to find instruments for assessment of morphological skills, as already pointed out by Correa (2005). It is emphasized that, although all the evidences used in this study have been used in previous studies, they have not gone through a process of standardization and validation. Moreover, the study design lacked a group of participants without problems to learn reading, in other words, children who had the same chronological age and/or same reading level of the participants with dyslexia. The performance of students with typical development could provide an important basis for comparison and analysis of the errors made by students with dyslexia.

Finally it stands out that this study—despite the limitations already explained (limited number of participants, the difficulty of finding evidence of morphological assessment of skills and absence of control participants with typical development)—has interesting implications for the educational process of teaching learning of students with dyslexia; they suggest the use of morphological analysis strategies in reading. This suggestion takes into consideration the difficulty of helping these students to improve their awareness of phonemes and therefore points a complementary strategy to teaching phonological awareness. So, starting from the knowledge of the students, in other words, their degree of sensitivity and awareness of morphemes in spoken language, they can

²Cunha & Cintra (2008) do not deal with the root concept in their grammar, referring only to radical.

be trained that words consist of small and large parts and gradually learn about the morphological structure of words, so that they can use such knowledge as a strategy to improve word recognition and reading mastery.

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