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Phonological-based errors on writing: coding of voiced and voiceless phonemes, segmentation and word junction

Erros de base fonológica na escrita: codificação de surdas e sonoras, segmentação e juntura vocabular

Mirian Aratangy Arnaut[1], Maria Mercedes Saraiva Hackerott[2], Gabriela Juliane Bueno[1], Pablo Felício Nepomuceno[1], Clara Regina Brandão de Ávila[1]

ABSTRACT

Purpose: The present study investigated the characteristics of phonological information processing as manifested in the writing of dictated syntagmas, capable of indicating possible correlations and the predictive impact between the analyzed orthography errors (coding of voiced and voiceless phonemes, undue segmentation and word junction) according to the school system. **Methods:** Eighty children from both genders, aged between 6 and 11 years, were selected from those regularly enrolled between the 2nd and 5th years of primary education, in both public and private schools in the municipality of São Paulo. The participants wrote, as dictated to them, 34 noun syntagmas composed of high frequency words. **Results:** The three types of error were correlated with one another according to different patterns in each school system. In the public schools, voice-voiceless coding errors and undue segmentations were positively correlated. Perception characteristics directed to the metric foot and the syllable might have influenced the children's performance. As for the results in private schools, the perception of the phonological word, phonological phrase and intonational phrase might have influenced the correlations between errors of the voiced-voiceless type and junctions. **Conclusion:** Voiced-voiceless coding errors, word junction and undue separation manifested differently between private and public schools, regarding writing performance. Only in private schools could the voiced-voiceless coding errors predict those of word junction and hypersegmentation.

Keywords: Handwriting; Education, primary and secondary; Speech, language and hearing sciences; Evaluation studies; Language; Psycholinguistics

RESUMO

Objetivo: O estudo investigou características do processamento da informação fonológica, manifestadas na escrita sob ditado de sintagmas, capazes de indicar possíveis correlações e algum impacto preditor entre os erros ortográficos analisados (codificação de fonemas surdos e sonoros, segmentação indevida, juntura vocabular), segundo a rede de ensino. **Métodos:** Foram selecionados 80 escolares, meninos e meninas, na faixa etária entre 6 e 11 anos, regularmente matriculados do 2º ao 5º ano do Ensino Fundamental, em escolas da rede pública estadual e particular, do município de São Paulo. Os participantes escreveram, sob ditado, 34 sintagmas nominais, formados por palavras de alta frequência. **Resultados:** Os três tipos de erros correlacionaram-se segundo padrões diferentes, em cada rede de ensino. Na rede pública, os erros de codificação surda sonora e segmentações indevidas correlacionaram-se positivamente. Características de percepção direcionada ao pé métrico e à sílaba, podem ter influenciado o desempenho dos escolares. Na rede particular, a percepção da palavra fonológica, da frase fonológica e da frase entonacional pode ter influenciado as correlações entre os erros do tipo surdo sonoro e as junturas. **Conclusão:** Os erros de codificação surdos sonoros, juntura vocabular e separação indevida diferenciaram-se nas redes de ensino, quanto ao desempenho em escrita. Apenas na rede particular os erros de codificação surdos sonoros puderam predizer os de juntura vocabular e segmentação indevida.

Descritores: Escrita manual; Ensino fundamental e médio; Fonoaudiologia; Estudos de avaliação; Linguagem; Psicolinguística

Study conducted at the Department of Speech-Language, Pathology and Audiology, Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.
(1) Department of Speech-Language, Pathology and Audiology, Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.
(2) Department of Marketing and Advertisement, Universidade Paulista – UNIP – São Paulo (SP), Brazil.
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Author's contribution: *MAA* main author and conducted the study design, chronogram design, literature survey, data gathering and analysis, article writing, and article submission; *MMSH* conceived the idea that gave origin to the study and hypothesis formulation, presented important suggestions that were incorporated into the study, and assisted in composing and correcting the article's text; *GJB* reviewed the article's text and performed the literature survey; *PFN* performed the literature survey and data analysis and wrote the article; *CRBA* an advisor, participated in the study design, chronogram design, data analysis, correction of the article's writing, and approval of the final draft.
Correspondence address: Mirian Aratangy Arnaut. R. Botucatu, 802, São Paulo (SP), Brazil, CEP: 04023-900. E-mail: mirian.arnaut@gmail.com
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INTRODUCTION

Writing may be understood as a representation of speech. In alphabetical writing, orthography performs the fundamental role of neutralizing speech variations[1]. A language's oral mode varies along time, space and the social group in which the speech takes place, as well as according to each discursive situation. Despite being an official standard imposed by law, orthography also varies along time. The greater or lesser correspondence to speech is what renders the written word more or less transparent[2-4].

Learning to write depends, fundamentally, on adequate phonological development and information processing that allow one to associate phonemes with graphemes. The phonological substrate, consisting of auditory memories and linguistic experiences, enables never before heard or visualized words to be written. Despite the recognized importance of processing different types of information, phonological information is undoubtedly the learning basis for the alphabetical principle, which is the first step towards mastering orthography. However, to reach this goal, in addition to phonological information processing, one must also have morphosyntactic and metagraphic skills[4,5], knowledge of vocabulary, and auditory and visual memory; there are also education constraints, such as the teaching method's characteristics and the socio-cultural factors in the schooling context[2-8]. Therefore, hypotheses based on phonological, semantic and mophosyntactic analyses, along with memory of both spoken and written words, complete the learning of orthography[9,10].

During the process of appropriating the orthographic system, it is natural for the child to make some mistakes. The necessary classification of these errors may help identify possible skill deficits underlying the learning of the alphabetic principle. Some of these errors are a normal part of development and can be overcome along the learning process, while others can only be corrected through clinic interventions[4,11,12]. In learning disorders, errors due to orthographic processes appear to be the most frequent ones, even if they are prevalently followed by errors related to phonological processes[12].

Different studies have proposed classifications of these errors found early in learning and/or in the learning difficulties or disorders. Some errors in orthography are determined by phonology-based deficits and have generally and consensually been classified as follows: errors in coding complex syllables; errors due to swapped letters - those most frequently observed are between voiced and voiceless consonants; segmentation errors - due to hypo- or hypersegmentation, as observed in text writing[11]. Certain authors have classified these errors based semiologically on natural orthography errors, which have a direct relation to language processing and arbitrary orthography, and errors directly related to visual memory, knowledge of orthographic rules, lexicon and morphology[4].

While learning to write, the child builds a series of hypotheses about the way words and sentences are recorded. He or she learns to perceive that a word is composed of syllables, made up of phonemes that are graphically registered by letters. Moreover, in oral communication, more specifically in chained speech, syllables are pronounced in tonal groups, which do not necessarily correspond to a word[1]. The pronunciation of tonal groups does not always coincide with the graphical spaces that delimit the words' boundaries. In oral communication, a tonal group may be formed by more than one word. This difference between pronunciation and the written record is not taken into account in activities that have words as unit of analysis, because recording isolated words does not reproduce the same system of pauses and intonation found in speech[1,13,14]. In chained speech, the word's phonic structure generally undergoes changes due to the coarticulation of its ending and the beginning of the following word, so that even a restructuring of the syllabic patterns may take place. This phenomenon is observed in what is known as word junction and hypersegmentation[12,15,16]. In Brazilian Portuguese, the stressed syllable has a greater sound volume or duration than unstressed syllables do, which characterizes the idiom's accented and non-syllabic rhythm[14]. This information is phonological and may influence, for example, the writing of syntagmas for which the child must realize that the orthographic division of the lexical items does not always correspond to the phonetic segmentation. Therefore, to identify errors characterized by word junction or hypersegmentation in the context of writing, one must analyze the phrase, the syntagma, and not just the word in isolation.

Despite this characteristic, a large portion of the surveys or evaluations of the ability to learn orthography are conducted only through the dictation of isolated words. The same procedure may be followed in the speech therapy or psychopedagogic clinic, which seeks to identify the difficulties and changes in the learning of writing, especially those related to deficits in orthographic processing. Therefore, in word dictation, the word junction and hypersegmentation errors are disregarded[2].

This study's justification is based on the need to determine the nature, characteristics and classification of these errors, which may be considered markers or indications of changes or deficits connected to phonological processes, which in turn should be investigated and treated in speech therapy clinics[17]. To this end, using syntagma dictation, three types of errors based on phonological development and knowledge were investigated: written coding of phonemes that distinguish themselves by the use of voice; undue junction between words (vocabulary) and segmentation, also considered to be related to phonological processing. The swapping of letters whose corresponding phonemes are opposed to one another by the use of voice, aside from being very frequent[12], are more promptly recognized in the field of education and in the speech therapy clinic. The connection to phonological development is easily identified because the persistent voicelessness in school-aged children is not uncommon.

One must know the nature and characteristics of errors, which although orthographically manifested, may be considered as markers or indications of changes or deficits in phonological processing. These changes must be considered relevant during the speech therapy investigation and in the clinic[17], especially when the child has already passed the stage in which segmentation, junction or letter swapping errors are common and, in a sense, even expected[1,12]. There are few studies related to this need, which appears to be more of a clinical that pedagogic nature, especially when considering school-attending children who make mistakes in writing after the learning phase, when these errors are normal and expected. Consequently, beyond the investigation into the presence of written-coding errors for phonemes that distinguish themselves by the use of voice, other changes in writing such as word junction or hypersegmentation, believed to be associated with phonological processing, were also investigated to help reduce possible distortions of the phonoaudiological evaluation clinic when designing phonological or orthographic profiles for errors in writing. From the literature's perspective, which distinguishes the production between private and public schools, the present study has distinguished these errors in both contexts[18,19].

According to the National Curricular Parameters (*Parâmetros Curriculares Nacionais* - PCN), it is expected that, from the end of the first cycle (5th year) of primary education, students will not make orthographic errors in "words of regular orthography or irregular, but frequent"[20]. In a sense, the orthographic error is a reflection of cognitive processes that indicate a given way of representing speech. They are visible traces of knowledge in that given moment. Orthography errors result from processes that are inherent to all learning and manifest the representation that underlies the written form[21-23].

In the literature, one finds analyses, tables and normatizations of errors, but only as they occur in isolated words. Issues regarding the perception of word boundaries are less frequently discussed. Neither does one find comparisons between errors made in dictations of isolated words[24], such as those found in the writing of words immersed in a phrasal context, in all basic education schools[18,25]. This work was developed from the hypothesis that differences exist and can be observed in different proportions in public and private schools.

Therefore, this study has sought to ascertain the characteristics of phonological information processing as manifested in writing among students in the First Cycle of Primary Education, during the dictation of syntagmas, which might indicate a possible correlation and some predictive impact between the orthographic errors being analyzed - namely, voiced and voiceless phoneme coding, hypersegmentation and word junction - based on whether the school is public or not. The voiced vs. voiceless phoneme coding error served as basis for the investigation into predicting an error's occurring on the heels of another, as this error is the most frequent[12] of the three chosen for this analysis.

METHODS

This study complements the pilot study of a project submitted to the Research Ethics Committee of the Universidade Federal de São Paulo (UNIFESP), approved under nº. 1768/11. The Terms of Agreement and of Free and Informed Consent were signed by the teaching institutions and the legal guardians of the participating children, respectively, before the data were gathered.

Sample selection

Eighty children (43 boys and 37 girls), aged between 6 and 11 years, regularly enrolled between the 2nd and 5th years of Primary Education either in schools of the state's public (PU) or private system (PV) in the municipality of São Paulo were selected. For each school year, twenty students were selected, 10 from the PU and 10 from the PV.

The children were selected according to the following previously defined inclusion criteria, for both groups: no complaints or indicators of hearing deficits; no complaints or indicators of (uncorrected) visual deficits; no complaints or indicators of neurological, behavioral or cognitive disorders; not having failed any school year.

The parents responded to a questionnaire with data about their children's development, and the teachers completed a form about their performance in school, to guarantee that the criteria for inclusion in the sample were being met.

Instruments

The dictation exam contained a list of 34 noun syntagmas, built from high-frequency words[25].

Procedures

1. Data gathering

The assessment sessions occurred during school hours, at times previously set by the school's coordinators and teaching staff and in a room chosen by the school's principal. The dictations were applied during the second school semester of 2012.

Participants received a black pencil and a sheet of paper with a specific area for identifying the record information (name, date and school year). After writing this identification, the students were given the following instruction: "I will dictate some words, and you should write these words down on the sheet you have received. If necessary, I will dictate more than once. If you make a mistake, strike what you have written through and write again next to it. You are not permitted to erase anything."

2. Data analysis

With the present work's objectives in view, possible errors

or imprecisions produced in the noun syntagma dictation exam were identified and then analyzed.

For the analysis and classification of writing errors, only voiced vs. voiceless phoneme coding, hypersegmentation and word junction errors were considered. The total number of errors found in the children's output was summated per type of error and per school system.

3. Statistical method

For statistical treatment of the results, the appropriate tests for performing the analyses required in this study were used.

Comparisons between groups were made by the Mann-Whitney test, which is the non-parametric equivalent of the t-test for independent measurements, given the asymmetric distribution of the variables involved.

The ascertainment of the existence of a correlation between the number of voiced-voiceless errors and the other variables in the study (word junction, hypersegmentation) was made using Spearman's correlation test because the data were not normally distributed (Kolmogorov-Smirnof).

To assess the predictive impact of the variable "number of coding errors for voiced and voiceless phonemes at the closing of word junctions" and "hypersegmentation", zero-inflated Poisson regression models were used. Due to the non-independent nature of the observations (children in the 2nd year, both in private and public schools, displayed a greater error count similarity among them than did children in later school years), the Poisson regression models were controlled by a multilevel *cluster* structure, thus yielding robust standard errors (RSEs). The independent regression models were generated both for PU and PV, and the inflation rate was kept constant. The adopted significance level was 0.05.

RESULTS

Intergroup comparisons were made, correlations between the variables in the study were investigated, and their predictive impact was assessed.

The comparisons made using the Mann-Whitney test showed that children in private schools (PV) made fewer errors than children in public schools (PU) did, for all items in the analysis. Significant differences were found (Table 1).

Spearman's correlation was used to investigate the existence of a correlation between errors in coding voiced and voiceless phonemes and the remaining types of error being studied - hypersegmentation and word junction (Table 2).

A significant and positive correlation (r=0.535, p<0.001) between orthographic errors when coding voiced/voiceless phonemes and hypersegmentation was observed in the PU data. The same correlation was observed between hypersegmentation and word junction (Table 3).

In the case of PV, correlations between errors in coding voiced and voiceless phonemes and word junction were observed (r=0.446*, p=0.004). When the school system was disregarded, it was observed that errors in coding voiced and voiceless phonemes did not correlate with hypersegmentation (r=0.270 p=0.092) but correlated with word junction errors (r=0.267*, p=0.017) (Table 4).

Table 1. Orthographic performance of primary education students from public and private schools

Variables	PU		PV		p-value
	Mean	SD	Mean	SD	
Voiced voiceless	5.40	1.10	5.40	1.10	<0,001*
Hypersegmentation	1.45	0.36	1.45	0.36	0,001*
Word junction	1.30	0.47	1.30	0.47	0,022*

* Significant values (p<0.05) – Mann-Whitney test

Note: PU = Public schools; PV = Private schools; SD = standard deviation

Table 2. Correlations between the types of orthographic errors for primary education students in public and private schools

Variables		Voiced voiceless	Hypersegmentation	Word junction
Voiced voiceless	Correlation coefficient (r)	1.000	0.544*	0.267
	p-value	-	0.000	0.017
	n	80	80	80
Hypersegmentation	Correlation coefficient (r)	0.544*	1.000	0.414*
	p-value	0.000	-	0.000
	n	80	80	80
Word junction	Correlation coefficient (r)	0.267*	0.414*	1.000
	p-value	0.017	0.000	-
	n	80	80	80

*Significant values (p<0.05) – Spearman's correlation coefficient

Table 3. Correlations between the types of orthographic errors among primary education students in public schools

Variables		Voiced voiceless	Hypersegmentation	Word junction
Voiced voiceless	Correlation coefficient (r)	1.000	0.535*	0.032
	p-value	-	0.000	0.843
	n	40	40	40
Hypersegmentation	Correlation coefficient (r)	0.535*	1.000	0.450*
	p-value	0.000	-	0.004
	n	40	40	40
Word junction	Correlation coefficient (r)	0.032	0.450*	1.000
	p-value	0.843	0.004	-
	n	40	40	40

*Significant values (p<0.05) – Spearman's correlation coefficient

Moreover, the number of orthographic errors in the PU data when coding voiced and voiceless phonemes was not a predictor of the remaining types of error considered in this study. However, all other orthographic errors were predicted by the number of errors in coding voiced and voiceless phonemes, in the PV data. This being the case, each error in coding voiced and voiceless phonemes increased the count of hypersegmentation errors by 0.384 and the count of word junction errors by 0.587 (Table 5).

DISCUSSION

Learning orthography depends, among other factors, on a metalinguistic knowledge of morphosyntactic phenomena, on adequate representations and processing of phonological information, which serve as a foundation for the phoneme-grapheme association[2,3,5-8]. In the Portuguese language, phonemes and graphemes establish both biunivocal and multiple relations.

In this study, errors of a purely orthographic nature

Table 4. Correlations between the types of orthographic errors among primary education students in private schools

Variáveis		Voiced voiceless	Hypersegmentation	Word junction
Voiced voiceless	Correlation coefficient (r)	1.000	0.270	0.446*
	p-value	-	0.092	0.004
	n	40	40	40
Hypersegmentation	Correlation coefficient (r)	0.270	1.000	0.212
	p-value	0.092	-	0.189
	n	40	40	40
Word junction	Correlation coefficient (r)	0.446*	0.212	1.000
	p-value	0.004	0.189	-
	n	40	40	40

*Significant values (p<0.05) – Spearman's correlation coefficient

Table 5. Predictive impact of "voiced-voiceless" swap orthographic errors of primary education students from public and private schools

	PU					PV				
	Impact of voiced-voiceless errors on (b)	RSE	p-value	95% CI		Impact of voiced-voiceless errors on (b)	RSE	p-value	95% CI	
Outcome										
Hypersegmentation	-0.018	0.022	0.415	-0.061	0.025	0.384	0.100	<0.001*	0.188	0.580
Word junction	0.054	0.067	0.427	-0.079	0.186	0.587	0.201	0.004*	0.192	0.982

*Significant values (p<0.05) – Zero-inflated Poisson regression models

Note: PU = public schools; PV = Private schools CI = confidence interval; RSE = Robust standard errors; (b) = Beta

(irregularities, multiple representation), which appeared with different frequencies, were disregarded due to the nature of the object of investigation, which was limited to analyzing errors in coding voiced and voiceless phonemes, hypersegmentation and word junction.

It is important to mention that, among the errors in coding voiced and voiceless phonemes, apart from those of orthographic transparency, there are also errors that displayed interference from Portuguese writing's opacity. This type of error is the one most frequently mentioned in the literature[12] and was also the most numerous in this study, both for the PU and PV data. Hypersegmentation and word junction errors were also found in the writing of dictated syntagmas (Table 1). When building hypotheses about writing, the pupil is influenced by prosody. However, because the prosodic boundary does not always coincide with that of words, undue word junctions and hypersegmentation of words were observed in the students' writing[15]. Thus, the results of our study confirm those in the literature.

These types of errors cannot be considered, or found, when the assessment protocols use isolated items[2]. Using noun syntagmas for the dictation revealed errors connected to the perception of the words' phonological structure, or of their syllabic segments or tonal groups. It also allowed a comparison of these errors among students, school years[26] and types of school.

As the most numerous errors observed in coding voiced and voiceless phonemes, the persistence and higher frequency of word junctions and hypersegmentations, especially in later school years, may indicate difficulties at the phonological level that still have not been overcome[12].

The statistical analysis identified a similar performance in writing for children in the 2nd school years, but different performances in subsequent years (Table 1), when comparing the two types of school. Errors in coding voiced and voiceless phonemes were the most frequent ones in both types of school and served best to distinguish between them, although the PU data also showed a worse performance in hypersegmentations and word junction than did the PV data. These data agree with those found in the literature, but one must stress that this literature refers to studies with the dictation of isolated words, for grading purposes[2,3,7].

The correlation of performances by error type (Table 2) - which revealed that with more errors in coding voiced and voiceless phonemes come more errors in undue word junction and hypersegmentation in children's syntagma writing - may indicate that these errors have the same phonological nature. However, when a correlation pattern was separately sought for each school system, it was observed in the PU data that errors in coding voiced and voiceless phonemes correlate positively only to hypersegmentation, which, in turn, also correlates positively to word junction (Table 3). Hypersegmentations are the allocation of spaces within the boundaries of a word, and may indicate that the child's perception might be directed to the lower constituents of the phonological organizational hierarchy, such as syllable and metric foot[14,27]. This evidence may therefore indicate a probable deficit in the perception of words as linguistic unit, leading the student to reproduce segmentations, which are internal to the lexical item, during the early stages of writing or in the presence of some disorder, when the frequency of this error is high. The question would be whether this perception is part of the development process, whether it is connected to vocabulary deficit or whether it denotes a loss or delay in phonological and/or hearing processing.

By contrast, for the PV data, only the word junction correlated positively with errors in coding voiced and voiceless phonemes (Table 4). Word junctions denote a lack of spacing between words' boundaries and can be mostly influenced by higher constituents of the phonological hierarchy[1], i.e., the tonal group, the phonological phrase or the intonational phrase. The way in which the child perceives these units in the language may influence its writing, making it harder to find the boundaries of words. Also in the PV group, the results showed a correlation between errors in coding voiced and voiceless phonemes and word junction, where the student perceives the tonal group, instead of the word, as the signifying unit. Faulty perception of phonological components might determine the permanence of this type of writing. The difference between the correlation patterns found for each school system showed that the developmental characteristics of the skills connected to phonological and orthographic information processing may differ between the PU and PV groups. It was observed that the number of errors in coding voiced and voiceless phonemes was not a predictor for the outcome of hypersegmentation and word junction in the regression model for PU students (Table 5). This result appears to be confirmed by the fact that errors of the voiced-voiceless type predicted the other errors being investigated (the frequency of word junctions and hypersegmentations) in the PV data. That is, in private schools, both hypersegmentations and word junctions were predicted by the number of errors in coding voiced and voiceless phonemes. Each error in coding voiced and voiceless phonemes increases the number of hypersegmentation errors by 0.384 and the number of word junctions by 0.587.

From the analysis of the results with respect to the number of errors in coding voiced and voiceless phonemes, considering that fewer errors were found in the PA data, one can raise the hypothesis that, among students in private schools, these errors might result from losses or deficits that characterize some type of learning disorder. The higher variability of the other types of errors found in the PU data for the four school years being studied might have defined this result, i.e., the variability of the errors was not defined just by the mean error values or mean standard deviations, but in qualitative terms, the PU data contained a larger number of errors of types which were not contemplated in this study.

The effects of schooling time on the errors found were not investigated in this study[1,2,11,12,15,17,18,28]. This fact is a limitation of the study, in the sense that the mean number of errors was computed over the four school years in each school system, and it was not possible to observe, in this sample, the effect related in most investigations conducted into the writing of children, especially in the first grades.

In a previous study[26], a similar performance was also observed in the second school years of public and private schools, followed by a widening gap in performance between the types of school from the 3rd to 5th years, with PV children having better performance, which appears to confirm the hypothesis that these types of errors are more specific in PV.

Word junctions and hypersegmentations are less frequently reported in studies about writing in primary education[28]. These types of writing anomalies can be observed in texts, sentences or syntagmas. The assessments made by means of isolated item dictation do not expose them. The results in this study have shown that voiced-voiceless swaps, present in the writing of isolated items, may be associated with other errors connected to the perception of prosodic constituents of words or sentences[1,27], indicating the need to stimulate the perception of phonological components of different linguistic structures.

CONCLUSION

In comparison with private school students, students from public schools presented more voiced and voiceless phonemes coding, hypersegmentation and word junction errors. The study of the correlations between the three types of errors showed different patterns in the two school types. In the PU data, coding of voiced and voiceless phonemes and hypersegmentation were positively correlated. A probable deficit in the phonological perception of constituents that was lower in the phonological hierarchy might have influenced the public school students' performance. In the PV data, deficits in the perception of the phonological word, phonological phrase and intonational phrase, constituents at higher levels in the phonological hierarchy, may have influenced the correlations between the errors in coding voiced and voiceless phonemes and word junctions. Only for private school students could the errors in coding voiced and voiceless phonemes predict hypersegmentation and word junction errors.

REFERENCES

1. Cunha APN, Miranda ARM. A influência da hierarquia prosódica em hipossegmentações da escrita de crianças de séries iniciais. Rev Virtual Estud Ling [internet]. 2007 [acesso em: 23 mar 2014];5(1) [19 p.]. Disponível em: http://www.revel.inf.br/files/artigos/revel_esp_1_a_influencia_da_hierarquia_prosodica.pdf

2. Morais AG. Ortografia: ensinar e aprender. 10a ed. São Paulo: Ática; 2009.

3. Queiroga BAM, Lins MB, Pereira MALV. Conhecimento morfossintático e ortografia em crianças do ensino fundamental. Psic: Teor Pesq. 2006;22(1):95-99. http://dx.doi.org/10.1590/S0102-37722006000100012

4. Fernández AY, Mérida JFC, Cunha VLO, Batista AO, Capellini SA. Avaliação e intervenção da disortografia baseada na semiologia dos erros: revisão da literatura. Rev CEFAC. 2010;12(3):499-504. http://dx.doi.org/10.1590/S1516-18462010005000056

5. Bousquet S, Cogis D, Ducard D, Massonet J, Jaffré JP. Acquisition de l´ortographe et mondes cognitifs. Rev Fr Pedagog. 1999;126:23-37.

6. Jaffré JP. Écritures et sémiographie. Linx. 2000;43:15-28. http://dx.doi.org/10.4000/linx.1038

7. Santos MTM. Vocabulário, consciência fonológica e nomeação rápida: contribuições para a ortografia e elaboração escrita. Rev Soc Bras Fonoaudiol. 2007;12(3):262. http://dx.doi.org/10.1590/S1516-80342007000300017

8. Gonçalves BAG, Capellini SA. Desempenho de escolares de 1ª série na bateria de identificação de erros de reversão e inversão na escrita: estudo preliminar. Rev CEFAC. 2010;12(6):998-1008. http://dx.doi.org/10.1590/S1516-18462010005000060

9. Largy P, Cousin MP, Bryant P, Fayol M. When memorized instances compete with rules: the case of number-noun agreement in written french. J Child Lang. 2007;34(2):425-37. http://dx.doi.org/10.1017/S0305000906007914

10. Justi FR, Pinheiro AMV. O efeito de vizinhança ortográfica no português do Brasil: acesso lexical ou processamento estratégico. Rev Interam Psicol. 2006;40(3):275-88.

11. Nobile GG, Barrera SD. Análise de erros ortográficos em alunos do ensino público fundamental que apresentam dificuldades na escrita. Psicol Rev. 2009;15(2):36-55. http://dx.doi.org/10.5752/P.1678-9563.2009V15N2P36

12. Zorzi JL, Ciasca SM. Análise de erros ortográficos em diferentes problemas de aprendizagem. Rev CEFAC. 2009;11(3):406-16. http://dx.doi.org/10.1590/S1516-18462009000300007

13. Rowe DW. Development of writing habilities in childhood. In: Bazerman C. Handbook of research on writing. New York: Lawrence Erlbaum; 2008. Capítulo 25, 401-19.

14. Chacon L. Hipersegmentações na escrita infantil: entrelaçamentos de práticas de oralidade e de letramento. Estud Ling. 2005;34:77-86.

15. Cagliari LC. Alfabetização e linguística. São Paulo: Scipione; 2009.

16. Chevrot JP, Dugua C, Fayol M. Liaison acquisition, word segmentation and construction in French: a usage-based account. J Child Lang. 2009;36(3):557-96. http://dx.doi.org/ 10.1017/S0305000908009124

17. Batista AO. Desempenho ortográfico de escolares do 2º ao 5º ano: proposta de elaboração de um protocolo de avaliação da ortografia [dissertação]. Marília: Universidade Estadual de São Paulo; 2011.

18. Moojen SMP. A escrita ortográfica na escola e na clínica: teoria, avaliação e tratamento. São Paulo: Casa do Psicólogo; 2009.

19. Bigarelli JFP, Ávila CRB. Habilidades ortográficas e de narrativa escrita no ensino fundamental: características e correlações. J Soc Bras Fonoaudiol. 2011;23(3):237-47. http://dx.doi.org/10.1590/S2179-64912011000300009

20. Ministério da Educação e do Desporto. Secretaria de Educação

Fundamental. Parâmetros curriculares nacionais: Língua portuguesa. Brasília: Secretaria de Educação Fundamental; 1997.

21. Meireles ES, Correa J. Regras contextuais e morfossintáticas na aquisição da ortografia da língua portuguesa por criança. Psicol Teor Pesq. 2005;21(1):77-84. http://dx.doi.org/10.1590/S0102-37722005000100011

22. Jaffré J-P. De la variation en orthographe. Étud Lingu Appl. 2010;3(159):309-23.

23. Teixeira SM, Grassi LM, Oliveira ND, Miranda ARM. Uma reflexão sobre os erros ortográficos e sobre a importância da formação teórica para a prática pedagógica de professores das séries iniciais. Verba Volant [internet]. 2011 [acesso em: 10 mar 2011];2(1):78-94. Disponível em: http://letras.ufpel.edu.br/verbavolant/segundo/ana2.pdf

24. Pinheiro AMV, Lúcio PS, Silva DMR. Avaliação cognitiva de leitura: o efeito de regularidade grafema-fonema e fonema-grafema na leitura em voz alta de palavras isoladas no português do Brasil. Psicol: Teor Prat. 2008;10(2):16-30.

25. Pinheiro AMV. Contagem de frequência de ocorrência de palavras expostas a crianças na faixa pré-escolar e séries iniciais do 1º grau. São Paulo: Associação Brasileira de Dislexia; 1996.

26. Arnaut MA, Hackerott MMS, Ávila CRB. Hipersegmentação, aglutinação e trocas entre surdas/sonoras em escolares do ciclo 1 do ensino fundamental. Sessão de pôster apresentada em: 21º Congresso Brasileiro de Fonoaudiologia; 22-25 set 2013; Porto de Galinhas (PE), BR.

27. Cunha APND, Miranda ARM. A hipo e a hipersegmentação nos dados de aquisição de escrita: a influência da prosódia. Alfa. 2009;53(1):127-48.

28. Capellini SA, Butarelli APKJ, Germano GD. Dificuldades de aprendizagem da escrita em escolares de 1a. 4a. séries do ensino público. Rev Educ Questão. 2010;37(23):146-64.