Original Article

https://doi.org/10.1590/2317-6431-2021-2591

Audiology Communication Research
ISSN 2317-6431

Is there an association between phonemic awareness and the reading ability of adolescents at secondary elementary school?

Há associação entre a consciência fonêmica e a leitura de adolescentes do ensino fundamental II?

Vanessa de Oliveira Martins-Reis[1], *Juliana Dafne Pereira de Melo*[1], *Kimberlinn Braga Mesquita*[1], *Luciana Cássia de Jesus*[2], *Luciana Mendonça Alves*[2,3]

ABSTRACT

Purpose: To ascertain the performance of adolescent's phonemic awareness and corroborate the association between this skill and reading. **Methods:** Eighty-three adolescents participated in the study consisting of 58 girls and 25 boys aged between 11 and 16 years of age all being enrolled in the 6th to 9th grades of secondary elementary school in two public schools in Belo Horizonte. Phonemic awareness tests and word and pseudoword reading test were carried out. **Results:** Adolescents had difficulty in performing the phonemic segmentation task, on the other hand when performing the CVC subtraction and inversion tasks there was a ceiling effect. A positive correlation was found between the phonemic awareness tasks and the reading of words and pseudowords. **Conclusion:** This study concluded that the development of phonological awareness is still necessary in adolescence, i.e. the development of this skill contributes significantly to good reading performance at secondary elementary school level.

Keywords: Language; Language Tests; Reading; Adolescent; Language and Hearing Sciences

RESUMO

Objetivo: caracterizar o desempenho de adolescentes em consciência fonêmica e verificar a associação entre essa habilidade e a leitura de palavras. **Métodos:** participaram do estudo 83 adolescentes, sendo 58 do gênero feminino e 25 do gênero masculino, com idades entre 11 e 16 anos, matriculados do 6º ao 9º ano do ensino fundamental II de duas escolas públicas de Belo Horizonte. Foram aplicados testes de consciência fonêmica e a prova de leitura de palavras e pseudopalavras. **Resultados:** os adolescentes apresentaram maior dificuldade em realizar a tarefa de segmentação fonêmica. Em contrapartida, na execução das tarefas de subtração de consoante/vogal/consoante e inversão, houve efeito teto. Observou-se correlação positiva entre as tarefas da consciência fonêmica e a leitura de palavras e pseudopalavras. **Conclusão:** O desenvolvimento da consciência fonológica ainda é necessário na adolescência e, além disso, se pode dizer que o desenvolvimento dessa habilidade contribui de forma significativa para o bom desempenho da leitura no ensino fundamental II

Palavras-chave: Linguagem; Testes de Linguagem; Leitura; Adolescente; Fonoaudiologia

Study carried out at Universidade de Brasília – UnB – Brasília (DF), Brasil.
[1]Curso de Fonoaudiologia, Faculdade de Ceilândia – FCE, Universidade de Brasília – UnB, Campus Ceilândia – Brasília (DF), Brasil.
[2]Programa de Pós-graduação (Doutorado) em Ciências Fonoaudiológicas, Faculdade de Medicina, Universidade Federal de Minas Gerais – UFMG – Belo Horizonte (MG), Brasil.
[3]Departamento de Fonoaudiologia, Faculdade de Medicina, Universidade Federal de Minas Gerais – UFMG – Belo Horizonte (MG), Brasil.
Conflict of interests: No.
Authors' contribution: VOMR conceived and outlined the project, participated in the analysis and interpretation of the results, reviewed writing of the manuscript and final approval of the version to be published. JDPM wrote the project, performed data collection, analysis of the results and wrote the manuscript. KBM wrote the project, performed the data collection, analyzed the results and wrote the manuscript. LCJ participated in writing the manuscript. LMA reviewed the manuscript and writing and final approval of the version to be published.
Funding: None.
Corresponding author: Vanessa de Oliveira Martins-Reis E-mail: vomartins@unb.br
Received: October 28, 2021; **Accepted:** February 18, 2022

INTRODUCTION

Phonological awareness allows one to perceive, manipulate and segment speech sounds, transform a grapheme into a phoneme and understand the sounds that letters represent. This skill can be divided into three levels, namely the awareness of syllabic, intrasyllabic and phonemic units. Phonological awareness develops gradually and increases with age and schooling, evolving the abilities to analyze the sound units of words[1-6]. The performance in phonological awareness tasks of typically developed adolescents is expected to be better than that of children.

According to research phonological awareness is directly related to reading success. The learning process directly influences the mastery of this ability to manipulate phonemes and phonemic awareness, which is routinely referred to in studies of reading development, and phonological awareness which is extremely important for the acquisition and development of reading[7-9].

A study by Michelino and Macedo[10] carried out with functionally illiterate adults showed that low performance in reading contributed to reduced performance in phonological awareness tasks, especially in phonemic manipulation tasks, since the expansion of phonological skills to higher levels of complexity depends on formal education.

The contribution of phonological awareness to the process of reading and writing occurs through the grapheme-phoneme association, which helps in decoding in word recognition, aides textual understanding and directly interferes with the reach of the alphabetic principle. This skill has a predictive role in the acquisition of reading skills[6].

One study highlighted the investigation and correlation of rapid serial naming with phonemic awareness and their contribution to reading and writing performance. 146 middle class and upper-middle-class North American children and adolescents aged between 7 and 18 years of age took part in this study. The results showed that both rapid serial naming and phonemic awareness are important for the development of reading skills, the first in helping to read texts quickly and accurately and the second in converting letters into their compatible sounds respectively. The findings support the fact that satisfactory reading performance is strongly linked to phonemic awareness[11].

Phonological awareness has been widely investigated in children, however there have not been sufficient studies of adolescents. This study gathers together a series of information that emphasizes the importance of evaluating phonological skills in adolescents from secondary elementary school. The objective of the research was to characterize the phonemic awareness performance of adolescents aged between 11 and 16 years of age and to evaluate the association between this skill and the reading of words and pseudowords.

METHODS

This is a cross-sectional analytical observational study, approved by the Research Ethics Committee of the Federal University of Minas Gerais, protocol number 1,722,230. All the adolescents who participated in the research signed the informed assent form and their guardians signed an informed consent form.

Casuistry

There were 83 adolescents in the research sample, 58 girls and 25 boys aged between 11 and 16 years of age. The educational break down was as follows 33.7% of the participants were in the 6th year, 26.5% in the 7th year, 24.1% in the 8th year and 15.7% were in the 9th year of secondary elementary school in two public schools in Belo Horizonte. Participants were selected through non-probabilistic convenience sampling.

The inclusion criteria used to select the study participants were as follows, they had to be normally developed for their age, enrolled in secondary elementary school education, and had to have previously taken phonological awareness and reading of words and pseudowords tests.

Candidates who presented uncorrected auditory and visual alterations, neurological, psychiatric, cognitive, and learning disorders (as reported by those responsible) and who did not complete the tests, were excluded from the research.

Instruments

1. Anamnesis questionnaire - A questionnaire was prepared by the researchers with questions regarding the health history and development of the adolescent, in order to identify possible developmental disorders. The questionnaire was completed by the adolescents' parents or guardians;
2. The Battery for Assessment of Written Language and Disorders (PhAB) phonological awareness test[12,13] - We only chose to use the phonemic manipulation tasks, namely segmentation, subtraction and inversion, since we expected that syllabic awareness had already been developed in the studied sample. Test stimuli were recorded to avoid interference. The phonemic segmentation test is composed of a total of eight pseudowords, six of which are monosyllabic and two disyllabic, which must be divided into phonemes. The phonemic subtraction task consists of ten pseudowords with a CVC (consonant/vowel/consonant) and CCV (consonant/consonant/vowel) structure for the participant to remove the first phoneme. The phonemic inversion test consists of five items of pseudowords formed by the structure CV (consonant/vowel) and five of the structure VC (vowel/consonant) that must be pronounced backwards;
3. Word and pseudoword reading test – WPRCT[14] - The test consisted of presenting a list of words and pseudowords, in which the adolescents had to read from left to right and aloud. Reading rate (number of words and pseudowords read per minute) and accuracy (number of words and pseudowords correctly read per minute) were calculated. It was considered correct when the items were read correctly and fluently. The following were considered errors: hesitations, revision strategies for corrections or spelling decoding errors.

Procedures

The students who were invited to participate in the study had to ask for permission from their parent or guardian to take part in the Language Development Assessment and sign a consent form. The authorized participants were then given a copy of the anamnesis questionnaire to be filled in by their parents or guardians and returned at the time of the evaluation, together with a signed the informed assent form.

Data was collected in a specially allocated quiet room during school times, so that they did not interfere with normal school activities. The evaluations were carried out individually and on average lasted 30 minutes.

In the phonemic segmentation task, the participants were instructed to orally segment the phonemes of the items presented. In the phonemic subtraction task, participants had to mentally subtract the phoneme from the beginning of each word and pronounce the rest aloud. In the phonemic inversion test, the participant had to mentally invert the phonemes of each item and orally produce the new pseudoword.

Each reading test was performed individually and recorded for transcription purposes and further analysis. A practice session in reading words and pseudowords was carried out before starting the task according to the test guidelines. The task was started after the evaluator pointed out the first word and asked the participant to start reading. As soon as the participant finished reading the list of words, the evaluator went on to the instructions for reading the list of pseudowords and advised the participant that it would work in the same way, but this time with invented words.

Data analysis

An Excel® spreadsheet was created for statistical analysis and SPSS software version 21.0 was used. In the data analysis descriptive measures of average, median, standard deviation, minimum, maximum and percentiles were used for continuous variables and frequency tables for categorical variables. For inferential analysis, the Mann-Whitney test and the Spearman correlation were used. The significance level adopted was 5%.

RESULTS

The descriptive measures of the adolescents' performance in phonemic awareness showed that their performance in the segmentation task was poorer than their performance in the other tasks. The Ceiling Effect appears in the CVC subtraction and inversion tasks, where students showed maximum performance (Table 1).

Regarding the classification of the performance of the adolescents in reading words and pseudowords, the levels of data classified as low and suitable were noted, showing that adequate performance excelled at lower levels (Table 2).

As for the descriptive measures of the performance of the adolescents in reading words and pseudowords, it was found that the adolescents performed better in measures related to reading words (Table 3).

The comparison of phonemic awareness performance among adolescents with low and adequate performance in reading words and pseudowords can be seen in Table 4. According to the Mann-Whitney test, adolescents with low performance in reading words have a poor performance in segmentation, CCV subtraction and total phonemic awareness.

The significant and positive correlation between the reading of words and pseudowords and phonemic awareness and weak correlations are shown in Table 5.

DISCUSSION

The purpose of this study was to analyze the performance of adolescents in phonemic awareness and to verify the association between this skill and the reading of words and pseudowords.

The results showed that the performance of the adolescents in the segmentation task was poorer in relation to the other tasks and 25% of the participants from all of the schools years were unable to perform this task, especially students in the sixth and seventh years. The study carried out with students who were completing primary elementary school showed that students had lower scores in the phonemic level tasks, in relation to the syllabic level, which reinforces the fact that the phonemic subtests are more complex, even for students about to enter high school[15]. Thus, raising the hypothesis that phonological awareness can still develop during adolescence.

Table 1. Descriptive measures of adolescents' performance in phonemic awareness tasks

		Segmentation	Subtraction	Subtraction	Inversion	Total Awareness Phonemic
			CVC	CCV		
Average		3.47	9.59	6.86	8.94	28.86
Median		3.00	10.00	8.00	10.00	30.00
Standard		2.716	1.279	3.429	1.525	6.428
Deviation						
Minimum		0	2	0	4	6
Maximum		8	10	10	10	38
Percentiles	25	0.00	10.00	5.00	8.00	26.00
	50	3.00	10.00	8.00	10.00	30.00
	75	5.00	10.00	10.00	10.00	33.00

Subtitle: CVC – consonant/vowel/consonant, CCV – consonant/consonant/vowel

Phoneme segmentation requires a more advanced level of phonological awareness, which involves letter sounds which require a more detailed knowledge of language and its structures. The results of an American study proved that even if adolescents are good at reading, their phonemic segmentation skills may still be undeveloped, and in cases of disuse of this skill, it may deteriorate or become even less evident[16].

A study carried out with students from the first to the fourth year of primary elementary school aimed to separately assess ten components of phonological awareness. One of the instruments used for evaluation was the phonological awareness test by Oral Production (PAOP). The results showed differences between the series and correlation between the scores and the subtests evaluated. The authors suggest that the syllabic and phonemic segmentation, phonemic synthesis, alliteration, phonemic manipulation and syllabic transposition subtests are especially important for even more advanced grades, because students' grades were strongly correlated with more complex subtests[17]. Consequently, we can affirm that it is relevant to perform the segmentation task to verify the performance of phonemic awareness in secondary elementary school students and show that this skill is being improved upon in adolescence.

A survey carried out with 50 six year old children from a public school in Rio de Janeiro divided the children into groups of readers and non-readers. The aim was to evaluate the performance of these students in tasks related to various linguistic-cognitive skills, the results being utilized for clinical and educational purposes. For assessment the authors used the Language development assessment (LDA) instrument, Rapid Automated Naming Test (RAN) and phonological awareness (PA) tasks involving both syllabic and phonemic segmentation. The results of the phonological awareness test showed that, in the tasks of synthesis, segmentation and phonemic transposition, there were no differences in the performance of the two groups. The idea that the segmentation task requires a greater development of phonological awareness at the phonemic level is reinforced in this study, as the data showed that even students with typical development and without any learning difficulties had problems with this task[18].

The analysis carried out in the study by Cárnio et al[19] showed that in primary elementary school phonological awareness evolves with schooling and that there is a strong relationship of reciprocity between phonological awareness and reading development.

Table 2. Classification of adolescents' performance in reading words and pseudowords

	Performance	f	%
Read Words	Low	18	21.7
	Adequate	65	78.3
	Total	83	100.0
Pseudowords Read	Low	28	33.7
	Adequate	55	66.3
	Total	83	100.0

Subtitle: f – frequency

Table 3. Adolescents' performance in reading words and pseudowords

		% Hits Words	% Hits Pseudowords	Rate Words	Rate Pseudowords	Word Accuracy	Pseudoword Accuracy
Average		96.80	87.60	79.00	48.20	77.00	43.00
Median		98.90	89.80	78.80	45.50	76.10	39.80
Standard Deviation		4.50	8.80	22.70	14.20	23.70	15.50
Minimum		71.60	61.40	23.00	19.10	16.40	12.00
Maximum		100.00	100.00	138.90	89.50	138.90	88.50
Percentiles	**25**	96.60	81.80	62.90	38.50	60.70	32.20
	50	98.90	89.80	78.80	45.50	76.10	39.80
	75	100.00	94.30	96.00	56.20	93.20	51.50

Table 4. Comparison of phonemic awareness and performance among adolescents with low and adequate performance in reading words and pseudowords

Words Read		Segmentation	Subtr. CVC	Subtr. CCV	Inversion	PA Total
	Average	1.83	8.83	5.50	8.61	24.78
	Median	1.50	10.00	7.00	9.00	26.00
Low	**SD**	1.79	2.46	3.62	1.75	7.01
	Average	3.92	9.80	7.23	9.03	29.98
	Median	4.00	10.00	8.00	10.00	31.00
Suitable	**SD**	2.76	0.54	3.31	1.46	5.82
Pseudowords read		**Segmentation**	**Subtr. CVC**	**Subtr. CCV**	**Inversion**	**PA Total**
	Average	3.00	9.25	6.21	8.96	27.43
	Median	3.00	10.00	8.00	10.00	29.50
Low	**SD**	2.60	2.01	3,.77	1.62	7.16
	Average	3.71	9.76	7.18	8.93	29.58
	Median	4.00	10.00	8.00	10.00	30.00
Suitable	**SD**	2.77	0.61	3.23	1.49	5.96

Subtitle: subtr. – subtraction, PA – phonemic awareness, SD – standard deviation, p<0.05; Mann-Whitney Test

Table 5. Spearman's correlation between phonemic awareness and reading of words and pseudowords

		Segmentation	Subtraction CVC	Subtraction CCV	Inversion	Total Phonemic Awareness
% Hits Words	*ρ*	0.380	0.306	0.356	0.230	0.423
	p-value	**<0.001**	**0.005**	**0.001**	**0.036**	**<0.001**
% Hits Pseudowords	*ρ*	0.394	0.433	0.487	0.355	0.530
	p-value	**<0.001**	**<0.001**	**<0.001**	**0.001**	**<0.001**
Word rate	*ρ*	0.451	0.255	0.420	0.310	0.511
	p-value	**<0.001**	**0.020**	**<0.001**	**0.004**	**<0.001**
Rate Pseudowords	*ρ*	0.279	0.183	0.282	0.171	0.334
	p-value	**0.011**	0.097	**0.010**	0.123	**0.002**
AccuracyWords	*ρ*	0.442	0.256	0.412	0.313	0.503
	p-value	**<0.001**	**0.019**	**<0.001**	**0.004**	**<0.001**
Accuracy Pseudowords	*ρ*	0.334	0.289	0.365	0.234	0.419
	p-value	**0.002**	**0.008**	**0.001**	**0.033**	**<0.001**

Subtitle: CVC – consonant/vowel/consonant, CCV – consonant/consonant/vowe

Although it is expected that secondary elementary school students should already be literate and with mastery of phonemic awareness, the data in this study showed that in this age group phonemic segmentation may not be well developed, especially for students with poor performance in reading. Such findings reinforce the need for this skill to continue to be monitored and stimulated in the final years of Elementary School.

The ceiling effect appears in the CVC subtraction and inversion tasks, in which the students showed maximum performance, whether or not they presented a reading rate with a high number of correct answers in the word and pseudoword reading test. The task did not allow differentiation of the reading performance of adolescents. In this case it is suggested that such tasks should not be used to monitor adolescents with typical development, and should be used with caution among adolescents with alterations in their learning process, since the individual tends to present impairment in phonological awareness skills[3]. The results of this study suggest that the CVC segmentation and subtraction tasks seem more suited to monitoring the metalinguistic development of adolescents.

Adequate performance in the word reading test and poor performance in the pseudoword test, the latter being considered when there was a low percentage of correct answers and losses in fluency during reading, shows that students may have had a poorer performance in the second test simply due to unfamiliar words. The phonological route is responsible for reading unknown words and it requires a greater and later decoding effort than the lexical route[20]. This also shows that the pseudoword test alone cannot be associated with phonological awareness[15].

It is important to note that, in general, all the adolescents who performed well on the word and pseudoword reading tests also performed well on the phonemic segmentation subtest of the phonological awareness test. However, in the statistical analysis we identified weak correlations between these two analyzed items, concluding that there are other factors that affect reading development, in addition to phonemic awareness. A significant and positive correlation between measures of reading words and pseudowords and measures of phonemic awareness can be seen. In general weak correlations were found, suggesting that other factors may contribute to reading performance, such as rapid naming, vocabulary, memory and others[21].

According to other studies there are factors that may interfere in the reading process, which may be genetic or environmental[21,22]. As seen, external factors can interfere with the development of reading, in addition to phonemic awareness, bringing weak correlations. Another study[23] analyzed the intervention of individual social and linguistic factors in the performance of students from the first to the fourth grades of primary elementary school in reading isolated words aloud. The results concluded that, among the social factors analyzed, only the mother's education was a factor of interference in reading, other relevant factors were the age of acquisition of reading and verbal comprehension.

The other issues related to the development of reading were not investigated in this study, pointing to a limitation of the research and reinforcing the need for future studies. Another limiting factor refers to the way in which the sample was selected. The analyzed results apply to the studied sample, constituting a limitation to the generalization of the results.

This study faced evident barriers in relation to the lack of research into language abilities of adolescents, mainly related to metalinguistic awareness and its typologies, and speech therapy. This gives an incentive for future studies on the exploration of this phase of human development and its language skills. We suggest that the analysis of the performance of adolescents in future studies should consider factors such as age and education, since they influence the performance of the sample.

CONCLUSION

We concluded that the adolescents at secondary elementary school that took part in the study, had greater difficulty with the phonemic segmentation task, suggesting that this skill continues to evolve at this stage of development. In addition, a positive, but weak, correlation was found between measures of phonemic awareness and analyzed reading. This result shows that there is an association between phonemic awareness and the reading of words and pseudowords in the sample studied, but other factors besides the mastery of this skill can influence the success of the reading process, consequently it is essential that the development of phonemic segmentation continues to

be monitored and encouraged in elementary schools, especially among adolescents with reading difficulties.

REFERENCES

1. Nicolau CC, Navas ALGP. Avaliação das habilidades preditoras do sucesso de leitura em crianças de 1º e 2º anos do ensino fundamental. Rev CEFAC. 2015 Jun;17(3):917-26. http://dx.doi.org/10.1590/1982-021620157214.
2. Santos IMS, Roazzi A, Melo MRA. Consciência fonológica e funções executivas: associações com escolaridade e idade. Psicol Esc Educ. 2020;24:e212628. http://dx.doi.org/10.1590/2175-35392020212628.
3. Rodrigues PN, Postalli LMM. Habilidades de consciência fonológica promovidas pelo ensino de leitura e escrita. Psicol Esc Educ. 2019;23:e189961. http://dx.doi.org/10.1590/2175-35392019019961.
4. Melo RB, Correa J. Consciência fonológica e a aprendizagem da leitura e escrita por adultos. Estud Pesqui Psicol. 2013;13(2):460-79. http://dx.doi.org/10.12957/epp.2013.8419.
5. Justi CNG, Henriques FG, dos Reis Justi FR. The dimensionatity of phonological awareness among Brazilian Portuguese-speaking children: a longitudinal study. Psicol Reflex Crit. 2021;34(1):26. http://dx.doi.org/10.1186/s41155-021-00192-x. PMid:34341848.
6. Godoy DMA. Aprendizagem inicial da leitura e da escrita no português do brasil: influência da consciência fonológica e do método de alfabetização [tese]. Florianópolis: Universidade Federal de Santa Catarina; 2005.
7. Carnio MS, Vosgrau JS, Soares AJC. The role of phonological awareness in reading comprehension. Rev CEFAC. 2017;19(5):590-600. http://dx.doi.org/10.1590/1982-0216201619518316.
8. Castro DAS, Barrera SD. The contribution of emergent literacy skills for early reading and writing achievement. Trends Psychol. 2019;27(2):509-22. http://dx.doi.org/10.9788/TP2019.2-15.
9. León CBR, Almeida A, Lira S, Zauza G, Pazeto TCB, Seabra AG, et al. Phonological awareness and early reading and writing abilities in early childhood education: preliminary normative data. Rev CEFAC. 2019;21(2):e7418. http://dx.doi.org/10.1590/1982-0216/20192127418.
10. Michelino MS, Macedo EC. Consciência fonológica, nomeação automática rápida e leitura em adultos analfabetos funcionais. CoDAS. 2021;33(1):e20190206. https://doi.org/10.1590/2317-1782/20202019206.
11. Cardoso-Martins C, Pennington BF. Qual é a contribuição da nomeação seriada rápida para a habilidade de leitura e escrita? Evidência de crianças e adolescentes com e sem dificuldades de leitura. Psicol Reflex Crit. 2001;14(2):387-97. http://dx.doi.org/10.1590/S0102-79722001000200013.
12. Godoy DMA, Cogo-Moreira H. Evidences of factorial structure and precision of phonemic awareness tasks (TCFe). Paidéia. 2015;25(62):363-72.
13. Godoy D. Por que ensinar as relações grafema-fonema? Rev Psicopedag. 2008;25(77):109-19.
14. Pinheiro AMV. Prova de leitura e de escrita de palavras. Belo Horizonte: FAPEMIG; 2013. Relatório Técnico Final aprovado pela Fundação de Amparo à Pesquisa do Estado de Minas Gerais—FAPEMIG.
15. Soares AJC, Jacinto LA, Cárnio MS. Memória operacional fonológica e consciência fonológica em escolares ao final do ciclo I do ensino fundamental. Rev Soc Bras Fonoaudiol. 2012 Dez;17(4):447-53. http://dx.doi.org/10.1590/S1516-80342012000400014.
16. Scarborough HS, Ehri LC, Olson RK, Fowler AE. The fate of phonemic awareness beyond the elementary school years. Sci Stud Read. 1998;2(2):115-42. http://dx.doi.org/10.1207/s1532799xssr0202_2.
17. Capovilla AGS, Dias NM, Montiel JM. Desenvolvimento dos componentes da consciência fonológica no ensino fundamental e correlação com nota escolar. Psico-USF. 2007;12(1):55-64. http://dx.doi.org/10.1590/S1413-82712007000100007.
18. Mousinho R, Correa J. Linguistic and cognitive skills in readers and nonreaders. Pro Fono. 2009 Jun;21(2):113-8. 2009;21(2):113-8. http://dx.doi.org/10.1590/S0104-56872009000200005. PMid:19629320.
19. Carnio MS, Sá BCM, Jacinto LA, Soares AJC. Phonological short-term memory and phonological awareness in students from the Elementary School. CoDAS. 2015;27(5):458-63. PMid:26648217.
20. Maranhe E. Uma visão sobre a aquisição da leitura e da escrita. São Paulo: Núcleo de Educação a Distância – UNESP; 2011.
21. Hempenstall K. Read About It: scientific evidence for effective teaching of reading. Australia: The Centre for Independent Studies; 2016. Research Report.
22. Vanderauwera J, van Setten ERH, Maurits NM, Maassen BAM. He interplay of socio-economic status represented by paternal educational level, white matter structure and reading. PLoS One. 2019;14(5):e0215560. http://dx.doi.org/10.1371/journal.pone.0215560. PMid:31048844.
23. Lucio PS, Pinheiro AMV, Nascimento E. O impacto da mudança no critério de acerto na distribuição dos escores do subteste de leitura do teste de desempenho escolar. Psicol Estud. 2009;14(3):593-601. http://dx.doi.org/10.1590/S1413-73722009000300021.