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Original Article

Artigo Original

Phonological short-term memory and phonological awareness in students from the Elementary School

Memória de curto prazo fonológica e consciência fonológica em escolares do Ensino Fundamental

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Keywords

Evaluation
Language
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ABSTRACT

Objectives: To characterize and compare the performance of students at the beginning and at the end of the elementary school in Short-Term Phonological Memory (STPM) and Phonological Awareness (PA). **Methods:** We assessed 80 students of both the genders who showed adequate linguistic and academic performance. The sample comprised 40 students in 1st grade and 40 in 5th grade from a public state school with mean age of 6.2 and 9.8 years, respectively. The STPM was assessed using a standardized test of Pseudoword Repetition. PA was assessed through a Sequential Assessment Test (CONFIAS). **Results:** No difference was found between the students of 1st and 5th years in STPM both in total score and concerning the similarity of the pseudowords. Regarding PA, there was a significant difference among the percentage distribution of correct answers in syllabic and phonemic tasks, and the students from 5th grade presented better performance. **Conclusion:** At the beginning and at the end of the elementary school, there is no difference in STPM performance. On the other hand, there is difference in PA, which highlights the influence of schooling on PA development. The correlation between STPM and PA only in 5th-year students suggests that, at the beginning of literacy, STPM cannot be considered as a predictor to children's performance in PA. Nevertheless, as the schooling advances, there is influence of PA on STPM.

Descritores

Avaliação
Linguagem
Memória
Aprendizagem
Escolaridade

RESUMO

Objetivos: Caracterizar e comparar o desempenho de escolares no início e término (1° e 5° ano) do Ensino Fundamental I, nas habilidades de Memória de Curto Prazo Fonológica e Consciência Fonológica. **Métodos:** Foram avaliados 80 escolares, de ambos gêneros, com bom desempenho escolar e linguístico, sendo 40 do 1º ano e 40 do 5º ano de uma escola estadual com média de idade, respectivamente, de 6,2 e 9,8 anos. Para a avaliação da Memória de Curto Prazo Fonológica (MCPF) foi utilizado um teste padronizado de repetição de pseudopalavras. A Consciência Fonológica (CF) foi avaliada por meio de um Instrumento de Avaliação Sequencial - CONFIAS. **Resultados:** Não houve diferença entre os escolares do 1º e do 5º ano no desempenho em MCPF, tanto na pontuação total quanto em relação à similaridade das pseudopalavras. Quanto à CF, houve diferença significativa entre as distribuições das porcentagens de acertos, tanto no subteste de consciência silábica quanto no de consciência fonêmica nos dois anos escolares, com desempenho superior dos escolares do 5º ano. **Conclusão:** No início e no término do Ensino Fundamental I, as habilidades de MCPF são semelhantes. O mesmo não acontece para a CF, evidenciando a influência da escolaridade sobre o desenvolvimento da CF. O fato de existir correlação entre MCPF e CF apenas para os escolares do 5º ano sugere que ao início da alfabetização a MCPF não pode ser considerada um preditor para o desempenho das crianças em CF. Entretanto, com o avanço da escolaridade existe influência da CF na MCPF.

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INTRODUCTION

Phonological Awareness (PA) is a metalinguistic skill that consists of the ability to identify, manipulate, and segment the minimum units of speech and contribute to the establishment of phoneme–grapheme association. It can be analyzed in two skill levels: syllabic and phonemic[1,2].

There is a reciprocal relationship between the development of phonological awareness and the development of reading and writing. The syllabic awareness, present in preschool, is developed to the level of the phoneme, favoring the acquisition of reading and writing skills. As linguistic tasks become more complex and the reading experience increases, the skills of phonological awareness are enhanced[2,3].

The phonological system processes information verbally encoded with two components: the phonological short-term memory (phonological loop), responsible for the storage of information for a short period of time; and subvocal feedback (articulatory loop), which rescues the verbal material in decline and keeps it in memory[4], assisting in the processing and organization of language.

Phonological operational memory or working memory will be named in this study as Short-Term Phonological Memory (STPM). However, when making comments on other studies, the terms used by the authors in their publications will be maintained. The STPM consists of a processing system that stores and manipulates information in a short period of time, which remain activated by repetition or by transfer to the long-term memory[5,6].

The temporary storage in memory has limited capacity, but we consider that with childhood development there is increased retention of phonological information.

Working memory and its relationship with language has been studied by many researchers, with variations on the objectives, procedures and/or instruments, and sample types (typical and/or some kind of linguistic change subjects, different ages, and different levels of schooling)[4-8].

There are several ways to assess the STPM, but there is still no consensus on the most appropriate way. Instant replay of letters, digits, pseudowords, and nonwords were used. The results showed that the maturation and development of memory occur according to chronological age and educational level[7,8].

Researchers[9-11] have demonstrated the role of phonological awareness in the schooling process and vice versa.

The relationship between verbal short-term memory (working memory/phonological operational memory) and PA has aroused the interest of researchers, with various studies approaching different age groups, educational levels, objectives, and language development (with and/or without disorders. Overall, it appears that memory and phonological awareness are interrelated and often inseparable and dependent on chronological age, maturity, and level of education of the subjects[6,8,12-16].

This study is relevant and differs from the above-mentioned literature as it has as objective to characterize and compare the performance of the students at the beginning and end (1st and 5th years) of the elementary school in the STPM and PA skills.

Although national studies[8,12-16] have evaluated these skills in the students of the elementary school, this is the first study in literature to make a comparative analysis between the 1st- and 5th-year students of the elementary school through the overall results accuracy for each test and analysis of each group in each subtest of the studied skills.

In this way, it is relevant to investigate and understand the influence of formal education process both in the STPM and in the PA, according to the advancement of education.

METHODS

This research was conducted after approval of the Institutional Ethics Committee under nº 402/11 and signature of informed consents by parents and/or guardians.

Materials and procedures

Procedures for selection of subjects

This study comprised 80 students, of both genders, 40 students of 1st year and 40 students of 5th year of a public elementary school, with mean age of 6.2 and 9.8 years, respectively. They met the following inclusion criteria: signature of the free informed consent; absence of complaints or cognitive, auditory, and/or visual impairment indicators; no prior or current oral language disorders absence of failure in school history and/or current learning difficulties; no psychological or speech language pathology and audiology treatment, and tutoring.

Parents and/or guardians responded to an anamnesis related to information on the overall development of language in their children and confirmation of the inclusion criteria.

The students underwent an individual screening that consisted of audiological evaluation, using the pediatric audiometer Interacoustics – PA5, to exclude hearing loss that could influence the patient's performance in the applied tests.

In addition, a speech and audiology screening was held at a predetermined room by the school board. Each child was individually evaluated through the Phonology test (Imitation) of the Child Language Test ABFW[17], and the oral counting story elicited by an image of action[18], in which the phonological, syntactic, semantic, and pragmatic aspects of the language were observed.

Specifically, for the students of 5th year, the School Performance Test (SPT) was used to assess written language, consisting of three subtests: reading, writing, and arithmetic[19]. The same was applied individually and interpreted in accordance to the descriptions of the instrument's manual, in order to achieve the overall performance of each student. We only sampled children with performance ranked as average or higher, according to the standard test for 5th-year students. This test was not applied to the students of 1st year, as it requires alphabetical writing level, absent in most children of that year.

The students who met the inclusion criteria comprised the sample, and the others were referred for speech and audiology therapy services and/or other specific locations.

Procedures for application of Experiment Tests

For the evaluation of STPM, we used the Pseudoword Repeat Test[20], composed of 40 pseudowords (10, 20, and 10 of low,

medium, and high similarities, respectively), following the phonological structure of Brazilian Portuguese. The students were evaluated individually in a specific location free of noise. At the time, they were instructed to repeat the pseudoword immediately after the assessor pronounced it. The score followed the criteria proposed by the test: correct answers worth one point and incorrect answers, zero. Therefore, 40 points are equivalent to 100% accuracy.

To evaluate the PA, we used the Sequential Assessment (CONFIAS)[21], containing two parts: syllabic level, consisting of nine items (synthesis, segmentation, identification of initial syllable, rhyme identification, word production with given syllable, identification of medial syllable, rhyme production, exclusion, and transposition) and phonemic level, consisting of seven items (production word that begins with the given sound, initial phoneme identification, final phoneme identification, exclusion, synthesis, segmentation, and transposition). For both parts, the score followed the criteria established by the authors (correct answers worth one point and incorrect, zero), with the possibility of reaching 40 points in syllabic part and 30 in phonemic. The test was applied orally and was provided visual support.

Data analysis

Initially, a descriptive analysis of the data obtained in each test was performed. For comparing STPM and PA skill results, response variable was considered as the overall percentage of scores in each of them.

To compare the means of the total percentage of correct answers in both grades and tests, the technique of analysis of variance (ANOVA) was used with repeated measures, considering two factors: school year (1st and 5th years) and applied evidence, in STPM and PA. To find the differences between the mean values, we used the Bonferroni procedure.

Pearson correlation coefficient was calculated to measure the correlation between total scores on tests of STPM and PA in each school year. Statistical analysis was performed with the aid of Minitab applications (version 16) and SPSS (version 18).

In the hypothesis test, 0.05 was set as significance level. Consequently, it was found that the assumptions for the application of ANOVA were not valid when considering the subtests in isolation. For this reason, we chose to use an inferential analysis, using a nonparametric test.

Thus, to compare both the school grades as to each of the subtests of the evidence of STPM and PA, the Mann-Whitney test was used.

RESULTS

In STPM test, the average of the total score among the students of 1st and 5th years were similar, with greater discrepancy observed in the pseudowords of low similarity (Table 1).

Similar results were obtained in inferential analysis between both grades, considering each subtest, as shown in Figure 1.

This type of analysis has confirmed that there was no statistical difference between the distributions of the score percentages in subtests of low (p=0.056), mean (p=0.257), and high (p=0.366) similarities in both school grades. However, the p-value obtained in the subtest of low similarity was close to 0.05.

Regarding the PA test, it was observed that the average percentage of correct answers in 5th-year students was higher than those in 1st-year students, both in syllabic tasks (p<0.001) and in phonemic tasks (p<0.001) (Table 2).

By inferential analysis of the students of 1st and 5th years, considering each subtest of the PA test, we found similar results (Figure 2).

The results of inferential analysis showed that there was a significant difference between distributions of score percentages in the syllabic awareness subtest (p<0.001) and the phonemic awareness (p<0.001) in both school grades, and the students of 5th year tend to have higher percentage of correct answers than 1st-year students.

ANOVA with repeated measures showed that the difference between the students of 1st and 5th years depends on the test (p<0.001) and that the difference between both the tests (STPM and PA) is not the same in both grades that is, there is interaction effect between school examination and year (Figure 3). We observed that, in 1st-year students, the average percentage of correct answers in the STPM test was higher than the average percentage of correct answers in the PA test (p=0.010). This difference was not observed in the students from 5th grade (p>0.999), as they showed high scores in both the tests applied.

Table 1. Percentage of hits in the Short-Term Phonological Memory per school year

Variable	n	Mean	Standard deviation	Minimum	Median	Maximum
Low similarity						
1st grade	40	90.5	9.9	60	90	100
5th grade	40	94.8	6.0	80	100	100
Medium similarity						
1st grade	40	92.4	9.0	50	95	100
5th grade	40	94.3	6.6	75	95	100
High similarity						
1st grade	40	98.0	4.1	90	100	100
5th grade	40	98.8	3.3	90	100	100
Memory (total)						
1st grade	40	93.9	4.3	85	95	100
5th grade	40	95.5	4.2	82.5	97.5	100

In STPM, there is no significant difference between mean percentage of correct answers when comparing both the school years (p=0.840). There was difference in PA, since the average percentage of correct answers by 5th-year students is greater than in 1st-year students (p<0.001).

The score behavior in both the events (STPM and PA) in each school grade is illustrated in the scatter diagram (Figure 4). There has been no trend in the cloud of points equivalent to 1st-year students. In contrast, it was observed in 5th-year students that the performance on a test tends to increase as the highest score in another.

While determining values of the Pearson correlation coefficient (r) between scores on both the tests in each group (1st year: r=0.02 [p=0.923]; 5th year: r=0.41 [p=0.008]), it was possible to observe that there was no correlation between PA and STPM in 1st-year students. However, in 5th-year students, there was a positive correlation between the tests applied. Thus, the students in 5th year showed that, the better the score in PA, the better the performance in the STPM test.

DISCUSSION

The results shown in Table 1 and Figure 1 indicated that, in the STPM test, the students of 1st and 5th years did not differ in relation to the total score, even when compared by subtests of low, medium, and high similarity, reaching almost the maximum scores.

In this research, we expected to have a significant difference between the students of 1st and 5th years, both in performance of the subjects in PA tasks and in the STPM for predicting the influence of the literacy process in its beginning and end, as described in literature[12,22,23]. However, this did not occur in the pseudowords repeat test (STPM), supporting a national study[3] whose results showed that short-term memory skills and access to mental lexicon of children of the elementary school do not depend on age and education.

A possible explanation for the performance of similarity in STPM in such different grades may result from phonological similarity of the pseudowords used in the test, a fact that favors the retention process and correct repetition of the target stimulus and enables greater success, regardless of education[13,24,25]. The pseudowords facilitate the storage of phonological information in STPM due to its associations with actual words of the language[25]. The data from this study support this hypothesis, as there was a greater difference between the groups in the words of low similarity. Therefore, we can speculate that if there were a greater number of pseudowords of low similarity, the difference in score between 1st- and 5th-year students could have been higher.

In phonological proximity, the long-term memory may influence the short-term by means of the lexicality effect. This effect, known as reintegration, attempts to repair incomplete or diffuse phonological representations (pseudowords) using permanent representations of long-term memory[26]. This recall is

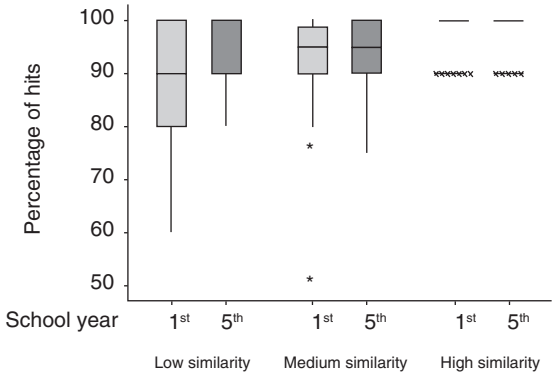

Figure 1. Box-plots of the percentage of hits in the subtests of the Short-Term Phonologycal Memory test

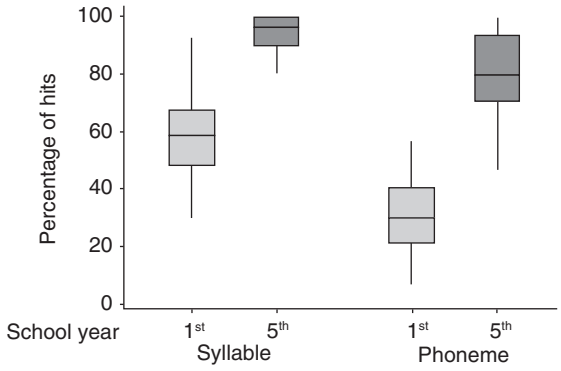

Figure 2. Box-plots of the percentage of hits in the subtests of the Phonological Awareness test

Table 2. Percentage of hits in the Phonological Awareness test per school year

Variable	n	Mean	Standard deviation	Minimum	Median	Maximum
Syllable						
1st grade	40	59.3	15.7	30.0	58.8	92.5
5th grade	40	93.9	6.3	80.0	96.3	100.0
Phoneme						
1st grade	40	30.7	12.8	6.7	30.0	56.7
5th grade	40	80.5	15.3	46.7	80.0	100.0
Confias (Total)						
1st grade	40	47.1	12.3	25.7	47.1	74.3
5th grade	40	87.4	11.1	48.6	89.3	100.0

facilitated especially if there is, besides phonological similarity, a relationship with the semantic value.

One study[27] analyzed four variables that influence short-term memory: lexicality, frequency, phonological similarity of nonword, and familiarity with the language. On the basis of their findings, the authors emphasized the importance of evaluating the STPM through nonwords, so as not to activate long-term memory for reintegration.

The aforementioned variables can account for the similarity in performance of the groups of this study, as phonological similarity and familiarity with the language were present in pseudowords of the test. The Pseudoword Repeat Test[20] was validated for Brazilian Portuguese-speaking children, with scientific rigor and, therefore, selected for this study, considering the lack of memory tests for the age group studied.

In future researches, the use of tests that have nonwords preferably with various extensions is suggested. However, if pseudowords are used, it is indicated that an equivalence in their number of similarity is made (low, medium, and high), maintaining the variability of extension. Thus, one can have a more sensitive tool for analyzing the STPM of the students of early grades of the elementary school.

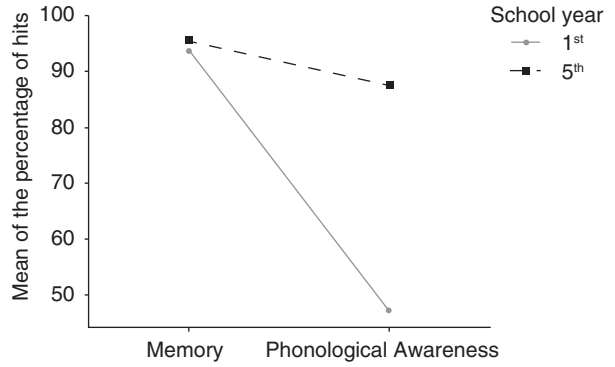

Figure 3. Means of the percentage of hits in the Short-term Phonological Memory test and in the Phonological Awareness test in each school year

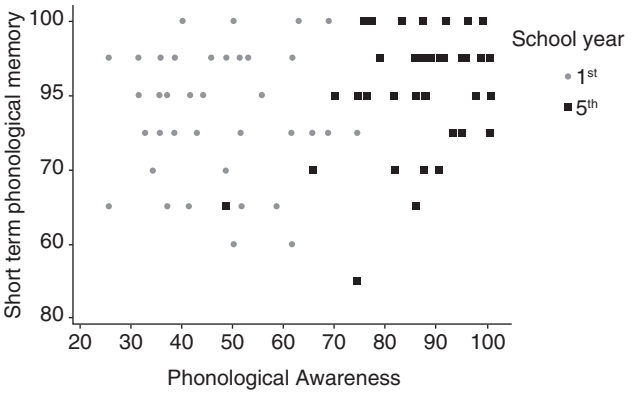

Figure 4. Scatter diagram of the grades in the Short Term Phonological Memory test and in the Phonological Awareness test in each school year

This study encourages reflection about the use of pseudowords and nonwords in the assessment of STPM. Nonwords, such as those used in other studies[23,25], purely activate the phonological system, ensuring greater accuracy in the evaluation of STPM skills. In this case, the only factor that can influence the storage capacity is the extension[12,25]. Therefore, nonwords appear to provide more consistent data on the STPM[8].

Regarding PA (Table 2 and Figure 2), mean score of 1st-year students were significantly inferior to the mean of 5th-year students, mainly in the syllabic tasks. This corroborates other studies, which highlight that the PA ability evolves with schooling and that there is a strong relationship of reciprocity between PA and development of reading and writing[3,21,28-30].

These data can be justified by the use of the synthetic method in the researched school, which reinforces the work in this regard. In addition, studies describe that the syllabic awareness is gained before phonemic, and the latter has its development and improvement with schooling[12,28-30].

The findings of this research also reinforces studies[13,28-30] that claim that, before formal schooling, children already possess the primary levels of PA — for example, syllabic awareness, which in turn helps in learning and is improved based on it, evolving to phonemic recognition, and confirming the bond of reciprocity between the acquisition of reading and writing and PA. Thus, the school has a fundamental role in finding a work involving the handling and the reflection of smaller sound segments in order to facilitate reading and writing learning[3,29].

Another relevant aspect to be highlighted is the fact that the students from the 5th year of this study did not reach the maximum score in CONFIAS, as that test was standardized for children with a mean age of seven years and medium/high socioeconomic status. Thus, it is speculated that extrinsic factors can influence the performance in PA as reported in a national study[13], because the students of this research are from a low socioeconomic community. It should be emphasized the importance of using another PA assessment tools that address normative data for the different education levels covered in this study, eliminating the possible influence of extraneous variables.

The data indicated a positive correlation between STPM and PA found in the 5th-year group, that is, the better the PA score, the better was the performance in STPM, which was not observed in 1st-year students (Figure 4). A possible explanation for this correlation in children with higher education may be the most significant domain in handling syllables and phonemes, which was settled with formal education, increasing the phonological information storage (phonological buffer). The correlation described in this study was also found in another national research[14].

The innovative contribution of this study was the lack of correlation between PA skills and STPM verified in the 1st school year, which suggests that good performance in STPM cannot be considered a predictor of PA in the beginning of the literacy period. However, in the later stages, the domain of PA skills can be a facilitator of the performance of the students in STPM.

CONCLUSION

This study shows that, at the beginning and at the end of the elementary school, STPM skills are similar. The same is not true for PA, as there is difference between the performance of the students of 1st and 5th years, showing the influence of education on the development of PA.

The fact that there is correlation between STPM and PA only for the students of 5th year suggests that, in the beginning of literacy, STPM cannot be considered a predictor of the performance of the children in PA. However, with the advancement of education, there is an influence of PA in STPM. Thus, these data indicate that, when analyzing the performance of the students, the range of education and its relation to the tests applied should be considered.

**MSC directed the research design, contributed to the analysis and interpretation of the data, and to the drafting, supervision, and editing of the manuscript; BCMS e LAJ were responsible for the collection, tabulation, and analysis of the data and for drafting of the manuscript; AJCS contributed to the analysis and the interpretation of the data and with the drafting and editing of the manuscript.*

REFERENCES

1. Wocadlo C, Rieger I. Phonology, rapid naming and academic achievement in very preterm children at eight years of age. Early Hum Dev. 2007;83(6):367-77.
2. Capellini SA, Oliveira AM, Pinheiro FH. Eficácia do programa de remediação metafonológica e de leitura para escolares com dificuldade de aprendizagem. Rev Soc Bras Fonoaudiol. 2011;16(2):189-97.
3. Tenório SMPCP, Avila CRB. Processamento fonológico e desempenho escolar nas séries iniciais do ensino fundamental. Rev CEFAC. 2012;14(1):30-8.
4. Baddeley A. Working memory and language: an overview. J. Commun. Dis. 2003;36(3):189-208.
5. Baddeley A. The episodic buffer: a new component of working memory? Trends Cognit. Sci. 2000;4(1):417-23.
6. Alloway TP, Gathercole SE, Willis CE, Adams A. A structural analysis of working memory and related cognitive skills in young children. J. Experim. Child Psychol. 2004;87(2):85-106.
7. Vaz IA, Cordeiro PM, Macedo EC, Lukasova K. Memória de trabalho em crianças avaliada pela Tarefa de Brown-Peterson. Pró-Fono Rev Atual Cient. 2010;22(2):95-100.
8. Grivol MA, Hage SRV. Memória de trabalho fonológica: estudo comparativo entre diferentes faixas etárias. J Soc Bras Fonoaudiol. 2011;23(3):245-51.
9. Cunningham AJ, Carroll JM. Reading-related skills in earlier e later schooled children. Sci Stud Read. 2011;15(3):244-66.
10. Furnes B, Samuelsson S. Phonological awareness e rapid automatized naming predicting early development in reading e spelling: Results from a cross-linguistic longitudinal study. Learn Individ Differ. 2011;21:85-95.
11. Ukrainetz TA, Nuspl JJ, Wilkerson K, Beddes SR. The effects of syllable instruction on phonemic awareness in preschoolers. Early Child Res Q. 2011;26(1):50-60.
12. Gindri G, Keske-Soares M, Mota HB. Memória de trabalho, consciência fonológica e hipótese de escrita. Pró-Fono R Atual Cient. 2007;19(3):313-22.
13. 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;17(4):447-453.
14. Cardoso AM, Silva MM, Pereira MMB. Consciência fonológica e a memória de trabalho de crianças com e sem dificuldades na alfabetização. CoDAS. 2013;25(2):110-114.
15. Silva C, Capellini AS. Desempenho de escolares com e sem transtorno de aprendizagem em leitura, escrita, consciência fonológica, velocidade de processamento e memória de trabalho fonológica. Rev. Psicopedagogia. 2013;30(91):3-11.
16. Nunes C, Frota S, Mousinho R. Consciência Fonológica e o Processo de Aprendizagem de Leitura e Escrita: Implicações Teóricas para o Embasamentoda Prática Fonoaudiológica. Rev CEFAC. 2009;11(2):207-12.
17. Wertzner HF. Fonologia. In: Andrade CRF, Befi-Lopes DM, Fernandes FDM, Wertzner HF. ABFW: Teste de Linguagem Infantil nas Áreas de Fonologia, Vocabulário, Fluência e Pragmática. Carapicuíba (SP): Pró-Fono, 2000.
18. Mayer M. Frog, where are you? New York: Ed. Pinguin; 1969.
19. Stein LM. Teste de Desempenho Escolar (TDE). São Paulo: Casa do Psicólogo; 1994.
20. Santos FH, Bueno OFA. Validation of the Brazilian Children´s Test of Pseudoword Repetition in Portuguese speakers aged 4 to 10 years. Braz J Med Biol Res. 2003;36(11):1533-47.
21. Moojen S, Lamprecht R, Santos RM, Freitas GM, Brodacz R, Siqueira M et al. Consciência Fonológica – Instrumento de Avaliação Sequencial (CONFIAS). Casa do Psicólogo: São Paulo; 2003.
22. Gindri G, Keske-Soares M, Mota HB. Comparação do desempenho de crianças pré-escolares e de primeira série em tarefas envolvendo a memória de trabalho. R Soc Bras Fonoaudiol. 2005;10(4):201-6.
23. Cunha VLO, Capellini SA. Desempenho de escolares de 1ª a 4ª série do ensino fundamental nas provas de habilidades metafonológicas e de leitura – PROHMELE. Rev Soc Bras Fonoaudiol. 2009;14(1):56-68.
24. Rodrigues A, Befi-Lopes DM. Memória operacional fonológica e suas relações com o desenvolvimento da linguagem infantil. Pró-Fono Rev Atual Cient. 2009;21(1):63-8.
25. Rodrigues A, Befi-Lopes D. Memória de curto-prazo fonológica em crianças pré-escolares. CoDAS. 2013;25(5):422-8.
26. Hulme C, Maughan S, Brown GDA. Memory for familiar and unfamiliar words: Evidence for a long-term memory contribution to short-term memory span. J Mem Lang. 1991;30(3):685-70.
27. Thorn ASC, Gathercole SE, Frankish CR. Reintegration and the benefits of long-term knowledge in verbal short-term memory: An evaluation of Schweickerts multinomial processing tree model. Cognitive Psychol. 1993;50(3)133-58.
28. Cárnio MS, Santos D. Evolução da consciência fonológica em alunos de ensino fundamental. Pró-Fono R. Atual. Cient. 2005;17(2):195-200.
29. Soares AJC, Cárnio MS. Consciência fonêmica em escolares antes e após oficinas de linguagem. J Soc Bras Fonoaudiol. 2012;24(1):69-75.
30. Capellini SA, Conrado TLBC. Desempenho de escolares com e sem dificuldades de aprendizagem de ensino particular em habilidade fonológica, nomeação rápida, leitura e escrita. Rev CEFAC. 2009;11(2):183-93.