Habilidades lingüístico-cognitivas em leitores e não-leitores***

Linguistic and cognitive skills in readers and nonreaders

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Abstract

Background: investigation of linguistic and cognitive skills in readers and nonreaders. Aim: to evaluate the performance of readers and nonreaders in tasks related to several linguistic and cognitive skills and to determine the implication of the results to the clinical practice and to eduaction. Method: participants of the study were 35 children in the process of alphabetization. The children were given tasks designed to assess their cognitive and linguistic abilities. The group of nonreaders was composed by 20 children who did not read any of the words presented on a list of 24 items. The group of readers included 15 children who read nearly every word presented on the same list. Results: the group of readers presented a better performance on the following tasks: language development assessment; alphanumeric rapid automatized naming and working memory. There was a great variability in the performance of readers and nonreaders in the phonological awareness tasks. For the group of readers, syllabic judgment and segmentation tasks were considered easy or very easy; syllabic transposition and phonemic subtraction presented medium difficulty and phoneme identification was considered a difficult task. For the group of nonreaders, syllabic segmentation was considered an easy task; syllabic judgment presented medium difficulty, and syllabic transposition, phonemic subtraction and phoneme identification were considered very difficult. Conclusion: the experience with reading influences the performance of children in linguistic and cognitive tasks. The performance of readers and nonreaders in the phonological awareness assessments indicates the importance of taking into account not only the required level of linguistic segmentation but also the cognitive level required by the nature of the task.

Key Words: Language; Cognition; Reading.

Resumo

Tema: investigação das habilidades lingüístico-cognitivas em leitores e não-leitores. Objetivo: avaliar o desempenho de leitores e não-leitores em tarefas relacionadas a diversas habilidades lingüístico-cognitivas estabelecendo a implicação desses resultados para a clínica e para a educação. Método: participaram da pesquisa 35 crianças cursando a alfabetização, que realizaram tarefas destinadas à avaliação de suas habilidades cognitivo-lingüísticas. O grupo de não-leitores foi formado por 20 crianças que não leram nenhuma de uma lista de 24 palavras, enquanto o grupo de leitores era formado por 15 crianças que leram quase todas as palavras. Resultados: Os leitores mostraram melhor desempenho nas tarefas: avaliação do desenvolvimento da linguagem; nomeação automatizada rápida alfanumérica e memória de trabalho. Houve grande variabilidade no desempenho de leitores e não-leitores nas avaliações de consciência fonológica. Para o grupo de leitores, identificação e segmentação silábica foram tarefas consideradas de fácil a muito fácil; transposição silábica e subtração de fonemas foram de média dificuldade e identificação fonêmica, uma tarefa difícil. Para os não-leitores, a segmentação silábica foi considerada tarefa fácil; identificação silábica, de média dificuldade, e tarefas de transposição silábica, subtração e identificação fonêmicas, muito difíceis. Conclusão: A experiência da leitura influenciou o desempenho das crianças em diferentes tarefas de natureza lingüístico-cognitivas. O desempenho de leitores e não-leitores nas avaliações de consciência fonológica traduz a importância de considerarmos não só o nível de segmentação lingüística requerido, mas também a demanda cognitiva exigida pela natureza da tarefa.

Palavras-Chave: Linguagem; Cognição; Leitura.

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Introduction

Reading involves integration of different cognitive-linguistic skills, particularly those related to phonological processing (1-3). Longitudinal and transverse studies (4-6) have emphasized the development of phonological awareness, working memory and rapid automatic naming as important to reading learning during first years of formal education. More limited and less systematic studies are experiments that investigate the opposite: the role of literacy on the development of cognitive-linguistic skills. Studies on the performance of readers and non-readers provide evidence for the understanding of such relationship (7-8).

Readers, compared to non-readers, present better performance on tasks of phonological awareness, working memory and explicit visual analysis (9-10). Neuroimaging studies on performance of non-literate and literate subjects on verbal language tasks corroborate to such results suggesting, still, the hypothesis that the functional brain architecture can be modulated by written language (8, 11).

Among the ways to describe the relationship between cognitive development and learning of written language, in the present study it was opted to perform a comparative analysis between groups of readers and non-readers composed by children with typical development. This way, we examined differences among children readers and non-readers of the same age, attending alphabetizing classes of the same school, on the development of cognitive-linguistic skills, particularly those related to phonological processing. Understanding of the influence of alphabetizing on such skills brings relevant implications for clinical practice and education.

Method

Fifty children who were attending alphabetizing class, and were participants of the research project approved by the Research and Ethics Committee of the Deolindo Couto Neurobiology Institute, participated in the study after parents signed a consent form. Given the great demand for the institution where the study was conducted - a school of reference in public education of Rio de Janeiro - the entry of children on literacy class is realized by drawing lots among the candidates. As a result, the children, although all being 6 years of age, presented differences on their reading and writing experience which ranged from spelling skills own name to analphabetism.

The groups of readers and non-readers were composed through the performance of children in a reading list of 24 words adapted to alphabetizing class by Capovilla and Capovilla (12). The non-readers group was composed by children who did not read any of the words from the list, while the readers group was composed by children who received the 25% higher scores on the reading task - which corresponded to fluent reading of at least 23 words. Thus, 20 children were included in the group of non-readers (average age = 6.7, SD = 2.87) and 15 children in the group of readers (average age = 6.8, SD = 3.95, Median = 24 words).

Children performed in May (classes start in February) a set of tasks that included the assessment of verbal language development, rapid automated naming, working memory and phonological awareness. The assessment of the development of verbal language was performed through the application of tests proposed for children from 6 years to 6 years and 11 months on the Language Development Evaluation Test (Avaliação do Desenvolvimento da Linguagem - A.D.L.(13), which comprises 8 items related to both language comprehension (comprehension of concepts involving quantitative language, speed, spatial relationship and temporal relationship) and language expression (ability of defining words, completing analogies, derivation of words, and memory for sentences). The naming skills were evaluated by the Rapid Automated Response Test N.A.R. (14), which involved items related to sequential naming of boards containing as stimuli: objects, colors, letters and digits. The assessment of working memory included tasks related to digit span (15) and nonword repetition (16). The tasks of phonological awareness - PA (17) involved the judgment of rhymes, syllabic and phonemic analyses. The assessment of syllabic awareness was composed by tasks of synthesis and segmentation of dissyllable, trisyllable and quadrisyllable words; identification of syllables in initial, medial and final position and transposition in words with two, three or four syllables. On phonemic level were included: tasks of subtraction of initial, medial or final position; phonemic synthesis and segmentation of words from three to seven phonemes; identification of words with the same phonemes in initial, medial and final position, and transposition of words with two to five phonemes.

Results

The NAR analysis was based on the grouping of tasks - at one side the figurative tasks (objects and

colors) and at the other the alphanumeric ones (digits and letters) - based on the principle that, although significant in terms of requiring verbal responses, they are conceptually distinct (18). The response of the children was measured by seconds needed for decoding the stimuli, therefore, the faster the response the better it was. The performance of the groups was compared by t Student test for independent samples. There was no significant difference between readers (M = 143.67, SD = 53.41) and non-readers (M = 136.60 SD = 37.60, t (33) =. 46 p = .65) for the naming of objects and colors. On the other hand, a significant difference between readers (M = 84.60, SD = 23.75) and non-readers (M = 118.58, SD = 57.22, t (25) = - 2.09 p = .046) was observed for the naming of numbers and letters.

Table 1 shows the performance of groups in terms of average proportion of correct responses on other measures related to cognitive-linguistic skills. The A.D.L. analysis was carried out considering a single score that grouped comprehensive and expressive tasks. The working memory was evaluated and analyzed based individually on tasks involving repetition of numbers and nonwords. Regarding the PA tasks, the subdivision according to the linguistic segmentation level requested at each task was conducted. This way, children's performance on tasks of phonological analysis performed at the rhyme, syllable and phonemes levels was performed. The performance of groups of readers and non-readers on the various tasks related to cognitive-linguistic abilities were compared by t Student test for independent samples.

There were significant differences between the means of readers and non-readers group in all tasks related to the assessment of cognitive-linguistic abilities of children. The performance of readers was, in statistical terms, significantly better than the group of non-readers on tasks of verbal language (ADL), working memory - such for the repetition of numbers as for the nonword repetition - and of phonological awareness on their various levels of analysis.

Regarding the assessment of phonological awareness, a more detailed analysis of the performance of children on tasks related to syllable and phoneme was performed once the assessment of the performance at these levels involved a number of different skills, as can be observed in Table 2. The performance of readers and non-readers on tasks of phonological awareness was compared using the Student t test for independent samples.

Observing Table 2, it is verified that there was no significant difference on the performance of readers and non-readers on the task of syllabic synthesis, phonemic synthesis, phonemic segmentation and transposition. The task of syllabic synthesis proved to be extremely easy for the children, being amongst the first acquisitions related to phonological awareness. Such results are consistent with those obtained by other Brazilian researchers (12, 14, 18). Thus, it is expected that children should present this ability even before entering the formal process of alphabetizing.

The other phonological awareness tasks which results showed no difference between the performance of readers and non-readers were those considered very difficult. These tests aimed to assess phonemic awareness such as synthesis, segmentation, and transposition of phonemes. Unlike the syllabic synthesis, the ability of phonological analysis expressed on these tasks is of late acquisition, which goes beyond the alphabetizing period (11, 17).

On the other hand, the following phonological awareness tasks were significant: syllabic transposition, segmentation and identification; phonemic identification and subtraction. Despite the difference on the performance of readers and non-readers in these tasks, it is observed that even for the group of readers, the performance varies considerably according to the cognitive demands of the task and the level of linguistic segmentation required (19).

Consistent with the psychometric analysis (20), we could distinguish five degrees of task difficulty according to the mean accuracy proportion of children: very difficult (0-.20), difficult (.20 -. 40), medium difficulty (.40 -. 60), easy (.60 -. 80) and very easy (.80 - 1). For the group of readers, syllabic identification and segmentation tasks were tasks considered from easy to very easy respectively; syllabic implementation and phonemic subtraction were both considered of medium difficulty and phonemic identification, a difficult task. For the non-readers group, the task of syllabic segmentation was considered an easy task, the syllabic identification a task of medium difficulty, and the tasks of syllabic implementation, subtraction and identification of phonemes were considered very difficult. The judgment of rhymes was of average difficulty for the group of non-readers, and very easy for the readers one.

In summary, the findings showed that alphabetizing seems to promote the development of verbal language skills, working memory, as well as most of the tasks of phonological awareness. In contrast, the fast automated naming proved to be less driven by the experience of reading learning, and proved to be significant only on alphanumeric tasks. There were no significant findings for syllabic synthesis - which did not differentiate the groups for being very easy - and the tasks of phonemic awareness, synthesis, phonemic segmentation and phonemic transposition - which were too complex for both groups.

TABLE 1. Linguistic-cognitive abilities of readers and non-readers.

	Readers Group (*n* = 20)		Non-readers Group (*n* = 15)				
	M	*SD*	*M*	*SD*	df	t	p
A.D.L.	.98	.05	.84	.21	22	2,73	,014*
Digit Span	.65	.20	.50	.21	33	2,16	.038*
Nonword repetition	.88	.10	.75	.24	27	2,22	.035*
PA-Rhyme	.90	.13	.47	.36	25	4,99	,000**
PA-Syllabic	.80	.08	.55	.20	27	5,11	,000**
PA-Phonemic	.15	.12	.03	.06	19	3,64	,002**

Note *p = .05; **p = .01

TABLE 2. Phonological awareness in readers and non-readers.

	Readers Group (*n* = 20)		Non-readers Group (*n* = 15)				
	M	*SD*	*M*	*SD*	Df	t	p
Syllabic Synthesis	.95	.10	.84	.31	24	1,46	.157
Syllabic Segmentation	.97	.07	.80	.33	21	2,29	,033*
Syllabic Identification	.76	.14	.46	.31	28	3,91	,001**
Syllabic Transposition	.52	.19	.10	.17	33	6,74	,000**
Phoneme Subtraction	.52	.43	.05	.22	20	3,80	,001**
Phonemic Identification	.34	.36	.11	.21	21	2,20	,039*
Phonemic Synthesis	.02	.06	.00	.00	-	-	
Phonemic Segmentation	.00	.00	.00	.00	-	-	
Phonemic Transposition	.00	.00	.00	.00	-	-	

Note *p = .05; **p = .01

Discussion

The comparison between the performance of readers and non-readers in different tasks related to different cognitive-linguistic skills allows us to broaden our understanding of the intricate relationship between development and learning of written language. The results are consistent with the hypothesis that the domain of written language present impacts on the cognitive-linguistic processing (10-11), pointing to the influence that alphabetizing brings, particularly to working memory and to alphanumeric rapid automatic naming skills. Readers showed better performance on the tasks of verbal language assessment, on repetition of digits and nonwords, as well as they designated letters and numbers faster than non-readers did. Results were similar to those obtained in other studies that compared children with and without specific written language learning difficulties (21) or groups of readers and non-readers adults (7-9).

The relationship between the learning of written language and the development of cognitive-linguistic abilities does not seem, however, unidirectional, but instead reciprocal - mainly in what concerns the development of phonological awareness. Thus, a certain level of phonological analysis would be expected prior to alphabetizing, thereby influencing the learning of written language. The results of this study show that this seems to be the case for skills related to syllabic awareness on the Brazilian Portuguese language. Syllabic synthesis and segmentation skills were presented as being very easy for non-reader children who participated in this study.

Moreover, according to the hypothesis of reciprocal causality (22), the domain of written language would promote further development of phonological awareness skills, as this study revealed, the significantly better performance of the group of readers as compared to the one of the non-readers in several phonological awareness tasks related to rhyme and syllable.

The identification of the development of cognitive-linguistic skills related to reading at the beginning of formal schooling seems to be of extreme relevance to provide parameters based on empirical evidence for the planning of early intervention programs to possible reading problems (19, 23, 24). The scores of the non-reader group on tasks of phonological analysis associated to the syllable suggest that the low performance on tasks of syllabic awareness, rather than performance on tasks of rhyme judgment, may indicate difficulties on the alphabetizing process on Brazilian Portuguese. In this sense, developing the skills of phonological awareness at the syllabic level appears to be important in terms of early stimulation, both on the educational and on the clinical point of view, in order to overcome initial difficulties in learning written language (25).

Items related to phonemic awareness were, on the other side, difficult, even for the readers, being such abilities - as suggested by the results of this study - developed during subsequent years to alphabetizing (17). Items related to the development of phonemic awareness do not seem to be, therefore, the best indicators during evaluation, either in clinical or in educational terms, of possible difficulties on the alphabetizing process on the Brazilian Portuguese language.

The results concerning the relative difficulty of different tasks of phonological awareness - which indicate the importance of phonological processing at the syllabic level over rhyme judgment and phonemic alliteration - contrast with the results of empirical evidence obtained for the English language (26), but, however, agree to results of readers and non-readers of the Spanish language(7). These results may be interpreted according to the syllable prominence in both Brazilian Portuguese and Spanish (27), corroborating to the hypothesis that the language with which the child learns to read particularly influences the development of phonological processing skills (28-30).

Conclusion

Better performance of the group of readers was observed on abilities of verbal language, automatic alphanumeric naming and working memory either for numbers or nonwords.

The considerable variability on the performance of readers and non-readers on assessments of phonological awareness reflects the importance of considering not only the level of linguistic segmentation requested but also the cognitive demand required by the nature of the task.

Our evidences suggest that the assessment of phonological skills based on one only result - by a composite measure of phonological awareness (obtained from the sum of different tasks), or by the choice of a single task - is of little value in clinical and in educational terms.

A more accurate assessment of phonological awareness of readers and non-readers - with educational or clinical purposes - would arise from the design of a profile of different abilities of phonological analysis presented by the child.

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