

Original articles

Performance of students with attention deficit hyperactivity disorder in metalinguistic skills, reading and reading comprehension

Desempenho de escolares com transtorno do déficit de atenção com hiperatividade em habilidades metalinguísticas, leitura e compreensão leitora

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Support Source: Capes

Study conducted at the Learning Deviations Investigation Laboratory, Speech and Hearing Sciences Department, School of Philosophy and Sciences, São Paulo State, University “Júlio de Mesquita Filho” – UNESP - Marília- São Paulo – Brazil

Conflict of interest: non-existent

ABSTRACT

Purpose: to characterize and compare the performance of students with Attention Deficit Hyperactivity Disorder in metalinguistic skills, reading and reading comprehension in students with good academic performance.

Methods: 30 participants from primary schools, of both genders, aged from 8 to 12 years and 11 months, divided into two groups: Group I consisted of 15 students diagnosed with Attention Deficit Hyperactivity Disorder and Group II composed of 15 students with good academic performance. The students were matched by age, grade level and gender. The students were submitted to Metalinguistic Skills Tests, Reading Protocol and Reading Comprehension Tests.

Results: differences were found between Group I and Group II for skills regarding initial and final phonemic identification, syllable and phonemes subtraction and addition, as well as phonemic segmentation. The performance of Group I was also inferior than that of Group II, in Reading protocol and repetition of non-words. There was no statistically significant difference between the groups in reading comprehension performance.

Conclusion: students with Attention Deficit Hyperactivity Disorder presented inferior performance in relation to reading protocol and in more complex metalinguistic skills, which required retention, analysis and information retrieval, when compared to the control group. In regard to reading comprehension, both groups presented lower performance, with similar results.

Keywords: Learning; Reading; Evaluation; Education; Attention Deficit Hyperactivity Disorder

RESUMO

Objetivo: caracterizar e comparar o desempenho de escolares com Transtorno do Déficit de Atenção com Hiperatividade em habilidades metalinguísticas, leitura e compreensão leitora, com escolares de bom desempenho acadêmico.

Métodos: participaram deste estudo 30 escolares do Ensino Fundamental I, de ambos os gêneros, na faixa etária de 8 anos a 12 anos e 11 meses de idade, divididos em dois grupos: Grupo I, composto por 15 escolares com diagnóstico de Transtorno do Déficit de Atenção com Hiperatividade; Grupo II, composto por 15 escolares com bom desempenho acadêmico. Os escolares foram pareados em relação à idade, à escolaridade e ao gênero e foram submetidos à aplicação das provas de habilidades metalinguísticas, de leitura e de compreensão de leitura.

Resultados: foi possível verificar desempenho inferior do GI em habilidades de identificação de fonema inicial e final, subtração e adição de sílabas e de fonemas, bem como de segmentação de fonemas. O desempenho do GI também foi inferior ao do GII em provas de leitura e de repetição de não palavras. Não houve diferença estatisticamente significativa entre o desempenho dos grupos em compreensão leitora.

Conclusão: os escolares com Transtorno do Déficit de Atenção com Hiperatividade em comparação com grupo controle apresentaram desempenho inferior na decodificação leitora e nas tarefas metalinguísticas consideradas mais complexas, as quais exigem retenção, análise e recuperação de informação. Na compreensão de leitura ambos os grupos apresentaram classificação de desempenho inferior com resultados semelhantes.

Descritores: Aprendizagem; Leitura; Avaliação; Educação; Transtorno do Déficit de Atenção com Hiperatividade

Received on: September 29, 2015

Accepted on: December 19, 2016

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INTRODUCTION

Some skills are fundamental for learning how to read, as language, attention to understand and interpret written language, auditory memory, visual memory, words identification, structural and contextual analysis of the language, logical synthesis and increased vocabulary. Thus, reading involves a variety of processes, beginning with visual identification of the letters, reaching fluency in word recognition and culminating into written message content comprehension¹.

Reading comprehension competently performed, becomes, therefore, the ultimate goal for learning how to read. However, several factors contribute for texts comprehension, but they are insufficient to determine it, separately. Particular attention is given to linguistic factors, such as the phonological processing that anchors the ability to decode the vocabulary and the syntactic knowledge² indispensable for comprehension; cognitive factors, working memory, monitoring and ability to establish inferences¹ as well as social factors, that involve the circumstances in which reading occurs (social context, goals, motivation and readers' expectations), and the readers' prior knowledge acquired through their socio-cultural experience³.

Among them, the metalinguistic skills of phonological awareness are predictive for reading development, because at the beginning of literacy the student needs to develop sensitivity regarding the internal structure of words, being able to identify and manipulate phonemes and syllables in order to decode them, afterwards⁴⁻⁷.

It is believed that there is a relationship between these skills and decoding, fluency and reading comprehension. For Gough and Tunmer⁸, there is a direct relationship between decoding and understanding; according to the authors, difficulties encountered in decoding would consequently bring difficulties in reading comprehension. Thus, after acquiring the metalinguistic skills, the student will be able to perform the conversion of graphic symbols into sounds, decoding them and performing words recognition. Comprehension is based upon the knowledge of these skills, but also on the vocabulary knowledge, the syntactic recognition process, reading fluency and the ability to make inferences, as well as attention, memory, comprehension of spoken language and executive functions (planning, organization, information control).

Studies have reported that students with attention deficit, work memory and executive function may

present impairments related to learning how to read; for example, students with Attention Deficit Hyperactivity Disorder (ADHD)⁹⁻¹³.

The American Psychiatric Association¹⁴ characterizes ADHD as a common neuropsychiatric disorder in childhood, with prevalent symptoms as inattention, hyperactivity, and impulsivity. Studies indicate that difficulties encountered in ADHD can be observed in more than one cognitive domain. The components of the executive functions most associated with possible cognitive impairments comprise planning, directed and selective attention, behavior regulation and motivation¹⁴⁻¹⁸, mainly caused by structural and chemical dysfunctions in the prefrontal cortex¹⁹.

Therefore, ADHD can be understood as a disorder with heterogeneous manifestations which causes broad impairments in cognitive and interpersonal functioning, presenting behavioral changes and low school performance, as main complaints^{17,18,20}.

In regard to reading, studies^{15,21-25} indicated that students with ADHD present difficulties related to decoding, such as reading errors due to grapheme-phoneme mismatches, sequencing failures in reading graphemes, errors by omission and by substitution of graphemes and / or words. These difficulties are caused by attention problems and use of the working memory to manage information necessary for the phonological processing of the items, and essential for making the correct orthographic representations of the words.

As for metalinguistic skills, students with ADHD present difficulties in activities which require greater attention and working memory, such as syllabic and phonemic manipulation²⁵.

In addition, studies have shown that students with ADHD present inferior performance in tasks involving organizational and planning skills^{15,18,20,21,24}, as well as reading comprehension skills when compared to students with good academic performance^{26,27}. Studies have reported that students with ADHD present reading comprehension impairments, which may be related to deficits in executive functions components. Due to difficulties in suppressing irrelevant information, sustained attention deficit and working memory, students with ADHD fail to develop a coherent text representation, since they are unable to effectively retrieve the previously read information. Therefore, text comprehension can be characterized by loss of relevant information^{23,28,29}. Authors also report that these students perform fewer inferences and, consequently, have difficulties to identify text inconsistencies^{26,29}.

Considering the exposed aspects, this article aimed to characterize and compare the performance of students with ADHD in metalinguistic skills, decoding skills and reading comprehension, with that of students presenting good academic performance.

METHODS

This study was approved by the Research Ethics Committee of the School of Philosophy and Sciences, São Paulo State University “Júlio de Mesquita Filho” – UNESP - Marília- São Paulo – Brazil, protocol number 957.995.

All the issues concerning the resolution of the National Health Council - CNS / 196 - on Guidelines and Norms Regulating Research Involving Human Beings and recommendations of the Research Ethics Committee of the Institution were respected. The people responsible for the participants of this study signed the Term of Free and Informed Consent, with explanation of the procedures, before they were performed.

Thirty students from Elementary School I, of both genders, aged from 8 to 12 years and 11 months, were divided into two groups.

Group I (GI): composed of 15 students with interdisciplinary diagnosis of Attention Deficit Disorder with Hyperactivity, without using medication, based on the evaluation carried out by the interdisciplinary team of the Laboratory of Investigation of Learning Deviations - LIDA/FFC/UNESP, composed by speech therapists, neuropsychologists and occupational therapists. The interdisciplinary diagnosis of Attention Deficit Hyperactivity Disorder was performed according to the criteria of the Statistical Manual for Mental Disorders and Behavior - DSM-5¹⁴.

Group II (GII): composed of 15 students with good academic performance paired by gender, schooling and age group with GI. Students were referred by their teachers, for presenting satisfactory accomplishment in two consecutive bimesters in Portuguese and Mathematics, with grades higher or equal to the average (5.0). From this referral, the students were submitted to the school performance test - SPT³⁰. For composing GII of this study, students who obtained the average or superior performance in reading, writing and arithmetic tests, were included. SPT was applied and analyzed by the researchers.

As exclusion criteria, the presence of sensory deficits (hearing and/or visual impairment), cognitive or physical deficits described in school records, were analyzed. In addition, students who were submitted to

some type of speech language pathology remediation were not included.

All the tests in this study were analyzed according to the error criterion. The students were submitted to the following evaluation procedures:

Metalinguistic and Reading Skills Tests - PROHMELE³¹: this protocol is composed by the following tests:

- **Tests of syllabic and phonemic identification:** Tests of syllable identification and initial, final and medial phonemes are presented.

The identification tests are arranged in 10 items, each one consisting of three words, totaling 30 words in each test. Each trio is constituted by a model word and two additional ones, in which the student should identify which one is similar to the given model, according to the position of the syllable or phoneme.

- **Tests of syllabic and phonemic manipulation:** syllabic tests and phonemic tests of segmentation, addition, subtraction, substitution and combination are presented, totaling ten tests.
- **Repetition of Non-words:** repetition of non-words, monosyllabic; repetition of non-words, disyllabic; repetition of non-words, tri-syllabic; repetition of non-words, polysyllabic with 4 syllables; repetition of non-words, polysyllabic with 5 syllables; repetition of non-words, polysyllabic with 6 syllables; distributed into six of each extension, that is, six monosyllables, six disyllables, six tri-syllables, and six polysyllables, divided into two words with four syllables; two with five syllables and two with six syllables, all paroxytones.
- **Reading Tests:** composed of a reading list of real isolated words (133 words) and by a reading list of non-words (27 non-words).

Non-words are regarded, here, as logatome, that is, a syllable or a sequence of syllables which belong to the language, but do not make up a word with meaning. Non-word derives from a real word, such as “bafata”, derived from “barata”, changing only one element and maintaining the syllabic pattern ³².

The reading tests were performed aloud and filmed for further reading analysis. Each student was instructed on how to read the words lists, presented in Arial size 14, double spaced, divided into columns, according to the words length (monosyllabic, disyllabic, tri-syllabic and polysyllabic - 4 to 7 syllables) and non- words (monosyllabic, disyllabic, tri-syllabic). For the non-words reading test, students were instructed to

read the words which do not exist and are not part of their vocabulary.

The characterization of types of errors concerning reading of real words and non- words was performed, based on the criteria established for the Brazilian Portuguese³², as described below:

- D1 Graphophonemic correspondence rule, regardless of the context referring to regular words with univocal correspondence, for words like **pato**, **bolo**, **faca**, **vela**, **tatu**, **dado**, **massa**, **moça**, **desço**, **chuva**, **janela**, **unha**, **carro**, **óculos**, **põe**, **água**, **lâmpada**, **rã**.
- D2 – Graphophonemic correspondence rule, depending on the context referring to the rules applied to irregular words, such as: **casa**, **zebra**, **costa**, **piscina**, **árvore**, **rato**, **cara**, **ganso**, **bolsa**, **homem**, **galho**, **gente**, **cinema**, **guarda**, **guizo**, **leque**, **quadro**, **exceção**, **xícara**, **exame**, **tórax**, **caixa**, **enxame**.
- D4 - Values of the letter “X” dependent exclusively on the mental and orthographic lexicon, which appear in words like **abacaxi**, **táxi**, **oxigênio**, **auxílio**, **próximo**.

Rule D3, as it refers to reading words in sentences, is not analyzed in this procedure. Rules which depend on metalanguage and / or textual and morphosyntactic and semantic context (D3) do not appear in our list or, consequently, in our analysis, since they are, as the name has already elucidated, dependent on a context in which reading needs to be based, in order to be performed properly. The reading test developed for this study consists only in reading isolated real words, not a metalinguistic and / or textual, morphosyntactic and semantic context. This rule was therefore, excluded.

For the non-words reading test, only rule D1 was considered, because it aims to verify the univocal correspondence between letter and sound.

The PROHMELE words and non-words reading was recorded by using a microphone. The researcher performed the recording using a *notebook*, for the material to be analyzed later.

The students’ answers were recorded on the answer sheet of the procedure. The students were instructed and trained in previous examples similar to those of the test, so that they knew what they should do, being evaluated so that they had no visual clue of the sounds articulation produced by the examiner.

Reading Comprehension Evaluation Protocol - PROCOMLE³³

This protocol was applied to characterize the reading comprehension profile of all the participants of this study, being composed of four texts (two narrative and two expository texts). Each text contains eight multiple-choice comprehension questions, four of them being related to the text microstructure (two literal and two inferential ones) and four related to the text macrostructure (two literal and two inferential ones).

For this study, the narrative text “The umbrella” and the expository text “The louse”, which are included in the evaluation protocol, were applied.

The students were asked to read the text very carefully, because after reading it, they should answer the questions about their comprehension, and were informed to read each question and each alternative very carefully, because only one corresponded to the correct answer.

GI students were evaluated in rooms of the Education and Health Studies Center (CEES), in opposition to their school period, and GII students were evaluated in their schools of origin during the school period, with permission of their teachers. The application of the metalinguistic skills tests was carried out individually, divided into two sessions of 30 minutes each; thus, in the first session, the evaluation referred to tests of identification and manipulation of syllables and phonemes. On the second session, reading evaluation and repetition of non-words were performed.

For the application of the Comprehension Assessment Protocol, a 30-minute session was applied for each text; one session for narrative text evaluation and one for expository text evaluation; both texts were applied collectively in groups comprising 5 students per session.

For both procedures, the analysis was performed by counting errors, that is, for correction, as punctuation criterion, zero was designed for correct and 1 for error, adding the amount of errors.

The results were analyzed statistically in order to compare intragroup and intergroup results. The IBM SPSS (*Statistical Package for Social Sciences*) program, version 22.0, was applied to analyze the results. The Mann-Whitney Test, Wilcoxon Signal Rank Test and *Jonkheere-Terpstra* Test were applied, with 5% (0.05), as a significance level, indicated with an asterisk in the tables related to the results.

RESULTS

The following tables show the performance of GI and GII in Metalinguistic and Reading Skills Tests - PROHMELE³¹ and the Assessment of Reading Comprehension Protocol – PROCOMLE³³.

Table 1 shows the mean of errors, standard deviation and p-value for GI performance. By applying the *Wilcoxon Signed Rank Test*, it was possible to observe a statistically significant difference in the comparison of skills regarding syllable identification and initial, final and medial phoneme; substitution of syllables and phonemes; and also between syllables

and phonemes segmentation, evidencing difference between the phonemic and syllabic tests among GI students. In this table, there was a lower mean of errors for the syllabic tests.

Table 2 presents the mean of errors, standard deviation and p-value for GII performance in reference to PROHMELE metalinguistic skills tests. By applying the *Wilcoxon Signed Rank Test*, a statistically significant difference was observed when comparing skills, such as identification, addition, and also syllable and phoneme segmentation, evidencing that the metaphonological skills tests performance was inferior, as compared to that in the syllabic test.

Table 1. Distribution of mean of errors values, standard deviation and p-value for Group I performance in metalinguistic skills tests

Pair of Skills	Mean of errors	Standard Deviation	p-value
IIS	0.27	0.59	0.017*
IIP	1.20	1.47	
IFS	0.80	1.27	0.019*
IFP	1.93	1.44	
IMS	1.93	1.67	0.032*
IMP	3.07	2.34	
SBS	1.80	1.61	0.051
SBP	2.93	1.83	
AS	1.93	1.62	0.054
AP	3.40	2.44	
SS	4.00	2.27	0.042*
SP	3.00	2.10	
CS	3.40	1.96	0.165
CP	4.13	2.56	
SS	0.67	1.18	0.001*
SP	6.20	3.63	

Legend: IIS- identification of initial syllable; IIP - identification of initial phoneme; IFS – Identification of final syllable; IFP – Identification of final phoneme; IMS – Identification of medial syllable; IMP – Identification of medial phoneme; SBS - Subtracting syllables; SBP – Subtraction Phonemes; AS– Addition of syllables; AP– Addition of phonemes; SS – Substitution of syllables; SP – Substitution of Phonemes; CS– Combination of syllables; CP– Combination of Phonemes; SS – Segmentation of syllables; SP – Segmentation of Phonemes; Wilcoxon Signed Rank Test ($p < 0.05$)

Table 2. Distribution of the mean of errors, standard deviation and p-value, referring to the performance of Group II in metalinguistic skills tests

Pair of skills	Mean of errors	Standard deviation	p-value
IIS	0.07	0.26	0.018*
IIP	0.80	0.86	
IFS	0.60	0.83	0.033*
IFP	1.13	0.92	
IMS	1.13	1.13	0.064
IMP	2.13	1.77	
SBS	0.87	0.99	0.516
SBP	0.73	0.80	
AS	0.47	0.64	0.046*
AP	1.40	2.13	
SS	2.07	2.05	0.684
SP	1.87	1.73	
CS	2.33	1.63	0.835
CP	2.53	2.00	
SS	0.20	0.41	< 0.001*
SP	9.73	0.80	

Legend: IIS- identification of initial syllable; IIP - identification of initial phoneme; IFS – Identification of final syllable; ; IFP – Identification of final phoneme; IMS – Identification of medial; IMP – Identification of medial phoneme; SBS - Subtracting syllables; SBP – Subtraction Phonemes; ; AS– Addition of syllables; AP– Addition of phonemes; SS – Substitution of syllables ; SP – Substitution of Phonemes ; CS– Combination of syllables; CP– Combination of Phonemes; SS – Segmentation of syllables; SP – Segmentation of Phonemes; Wilcoxon Signed Rank Test ($p < 0.05$)

Table 3 shows that the mean, standard deviation and p-value and a statistically significant difference are observed when comparing G1 and GII, concerning skills such as identification of final phoneme, subtraction of phonemes, addition of syllables, addition of phonemes, subtraction of syllables and segmentation of phonemes.

It is also noteworthy that skills regarding the identification of final phonemes, subtraction of phonemes, addition of syllables, addition of phonemes and subtraction of syllables, for GII mean of errors was lower when compared to that of G1, evidencing that

G1 students presented inferior performance when compared-those of GII.

The *Mann-Whitney test* was used in Table 4, in order to verify the differences between the groups. The mean, standard deviation and p-values were observed when comparing the performance in reading tests between G1 and GII; both for reading real words and for non-words, there was a statistically significant difference between G1 and GII, considering that G1 performance was lower than that of GII.

Table 3. Distribution of mean of errors, standard deviation and p-value, referring to the comparison of the performance of Group I and Group II in metalinguistic skills tests

Skills	Groups	Mean of errors	Standard Deviation	p-value
IIS	GI	0.27	0.59	0.276
	GII	0.07	0.26	
IIP	GI	1.20	1.47	0.594
	GII	0.80	0.86	
IFS	GI	0.80	1.27	0.888
	GII	0.60	0.83	
IFP	GI	1.93	1.44	0.047*
	GII	1.13	0.92	
IMS	GI	1.93	1.67	0.191
	GII	1.13	1.13	
IMP	GI	3.07	2.34	0.247
	GII	2.13	1.77	
SBS	GI	1.80	1.61	0.115
	GII	0.87	0.99	
SBP	GI	2.93	1.83	< 0.001*
	GII	0.73	0.80	
AS	GI	1.93	1.62	0.003*
	GII	0.47	0.64	
AP	GI	3.40	2.44	0.010*
	GII	1.40	2.13	
SS	GI	4.00	2.27	0.022*
	GII	2.07	2.05	
SP	GI	3.00	2.10	0.124
	GII	1.87	1.73	
CS	GI	3.40	1.96	0.134
	GII	2.33	1.63	
CP	GI	4.13	2.56	0.077
	GII	2.53	2.00	
SSI	GI	0.67	1.18	0.297
	GII	0.20	0.41	
SP	GI	6.20	3.63	0.001*
	GII	9.73	0.80	

Legend: IIS- identification of initial syllable; IIP - identification of initial phoneme; IFS – Identification of final syllable; IFP – Identification of final phoneme ; ; IMS – Identification of medial syllable; IMP – Identification of medial phoneme; SBS - Subtracting syllables; SBP – Subtraction Phonemes; AS– Addition of syllables; AP– Addition of phonemes ; SS – Substitution of syllables; SP – Substitution of Phonemes; CS– Combination of syllables; CP– Combination of Phonemes; SS – Segmentation of syllables; SP – Segmentation of Phonemes; *Mann-Whitney Test.* ($p < 0.05$)

Table 4. Distribution of the mean of errors, standard deviation and p-value, referring to the comparison of the performance of Group I and Group II in reading tests

Skills	Groups	Mean of errors	Standard deviation	p-value
Real words	GI	39.80	26.39	< 0.001*
	GII	6.47	3.89	
Non- words	GI	8.60	4.09	< 0.001*
	GII	2.07	1.34	

Legend: *Mann-Whitney test.* ($p < 0.05$)

Table 5 presents the mean of errors, standard deviation and p-value for students with ADHD (GI) in the non-words repetition test, employing the *Friedman Test*. A statistically significant difference was observed

among the monosyllabic, disyllabic, tri-syllabic and polysyllabic non-words, showing that the performance of the students with ADHD was influenced by the word length.

Table 5. Distribution of the mean of errors, standard deviation and p-value for non-word repetition test of Group I

Tests	Mean of erros	Standard Deviation	p-value
RNW_M	0.27	0.80	
RNW_D	0.27	0.46	
RNW_T	0.47	0.83	
RNW_P4	0.40	0.63	< 0.001*
RNW_P5	0.60	0.74	
RNW_P6	1.40	0.63	

Legend: RNW_M: Repetition of non-monosyllabic word; RNW_D: Repetition of non-word disyllabic; RNW_T: Repetition of non-word tri-syllabic; RNW_P4: Repetition of non-word polysyllabic, 4 Syllables; RNW_P5: Repetition of non-word polysyllabic, 5 Syllables; RNW_P6: Repetition of non- word polysyllabic, 6 Syllables; *Friedman Test* (p < 0.05)

Table 6 shows the mean of errors, standard deviation and p-value for the non-words repetition test of GII students. Table 7 shows a statistically significant difference in the non-word repetition test. The mean

of the errors, standard deviation and p-value of the students' performance for the control group (GII) could be observed, by applying The *Friedman Test*.

Table 6. Distribution of the mean of errors, standard deviation and p-value for non-words repetition test of Group II

Tests	Mean of errors	Standard Deviation	p-value
RNW_M	0.00	0.00	
RNW_D	0.13	0.52	
RNW_T	0.27	0.70	
RNW_P4	0.13	0.35	< 0.001*
RNW_P5	0.27	0.46	
RNW_P6	0.73	0.70	

Legend: RNW_M: Repetition of non-monosyllabic word; RNW_D: Repetition of non-word disyllabic; RNW_T: Repetition of non-word tri-syllabic; RNW_P4: Repetition of non-word polysyllabic, 4 Syllables; RNW_P5: Repetition of non-word polysyllabic, 5 Syllables; RNW_P6: Repetition of non- word polysyllabic, 6 Syllables; *Friedman test* (p < 0.05)

From the results described in Tables 5 and 6, in which statistically significant differences were found, the *Wilcoxon Signed Rank Test*, adjusted by *Bonferroni Correction* was applied to identify the variables which differ from each other, when compared two by two.

Table 7 presents the distribution of p-value when comparing the variables of groups GI and GII for the non-word repetition tests. It was observed that, in the comparison between the repetition tests of non-polysyllabic words (6 syllables) and monosyllabic words, GI presented a statistically significant difference. There was also a statistically significant difference in the comparison between the repetition tests of

non-polysyllabic words (6 syllables) and disyllabic words, and in the comparison between the repetition tests of non-polysyllabic words of 6-syllable length and the polysyllabic ones of 4-syllable length, also for GI. GII presented a statistically significant difference in the comparison between the non-polysyllabic (6 syllables) and non-polysyllabic words repetition test (4 syllables), showing the difference concerning the length of non-word segments, where the amount of errors for words with larger quantity of segments was higher, as compared to non-words with lower number of segments.

Table 7. Distribution of the p-value for non-word repetition test

Pair of skills	p-value	
	Group GI	Group GII
RNW_D – RNW_M	0.705	0.317
RNW_T – RNW_M	0.496	0.157
RNW_P4 – RNW_M	0.483	0.157
RNW_P5 – RNW_M	0.238	0.046
RNW_P6 – RNW_M	0.003*	0.005
RNW_T – RNW_D	0.317	0.317
RNW_P4 – RNW_D	0.564	> 0.999
RNW_P5 – RNW_D	0.190	0.480
RNW_P6 – RNW_D	0.003*	0.007
RNW_P4 – RNW_T	0.665	0.414
RNW_P5 – RNW_T	0.608	> 0.999
RNW_P6 – RNW_T	0.023	0.035
RNW_P5 – RNW_P4	0.317	0.317
RNW_P6 – RNW_P4	0.002*	0.003*
RNW_P6 – RNW_P5	0.010	0.035

Legend: RNW_M: Repetition of non-monosyllabic word; RNW_D: Repetition of non-word disyllabic; RNW_T: Repetition of non-word tri-syllabic; RNW_P4: Repetition of non-word polysyllabic, 4 Syllables; RNW_P5: Repetition of non-word polysyllabic, 5 Syllables; RNW_P6: Repetition of non- word polysyllabic, 6 Syllables; *Wilcoxon Signed Rank Test; Bonferroni Correction* ($p < 0.003$)

The *Mann-Whitney Test* was applied in Table 8, in order to verify the possible differences between the groups studied. For this analysis, the total of correct answers of the expository text questions was applied.

There was no statistical significance, that is, the groups presented similar performance. Table 8 shows the distribution of the mean, standard deviation, minimum and maximum, percentile, median and p-value of the total scores for GI and GII, in the expository text questions.

In this table, when verifying the values of GI percentiles, a variability of 3 to 4 correct answers between percentile 25 and the median was observed, the performance mean of these students being 3.93.

There was a higher value for standard deviation in GII, indicating a greater variability of responses; in this table the mean was between the interval of median and percentile 75.

Table 8. Distribution of the mean, standard deviation, minimum and maximum, percentile, median and p-value for correct answers total of Group I and Group II in expository text questions

	Group	N	Mean	Standard Deviation	Minimum	Maximum	Percentile 25	Median	Percentile 75	p-value
Total of correct answers	GI	15	3.93	1.16	2.00	6.00	3.00	4.00	5.00	0.302
	GII	15	3.60	2.26	1.00	8.00	2.00	3.00	6.00	

Legend: *Mann-Whitney test* ($p < 0.05$)

Table 9 shows the results of the *Jonckheere-Terpstra Test*, in order to verify the possible differences between the groups studied, in relation to the narrative text. For this analysis, the total of correct answers of the

narrative text questions was considered. There was no statistical significance, that is, the groups presented a similar performance.

Table 9. Distribution of the mean, standard deviation, minimum and maximum, percentile, median and p-value for correct answers total of Group I and Group II in expository text questions

	Group	N	Mean	Standard Deviation	Minimum	Maximum	Percentile 25	Percentile 50 (Median)	Percentile 75	p-value
Total of correct answers	GI	15	4.87	1.60	2.00	7.00	4.00	5.00	6.00	0.674
	GII	15	4.33	2.50	0.00	8.00	2.00	5.00	6.00	

Legend: *Jonckheere-TerpstraTest* ($p < 0.05$)

DISCUSSION

Through the results of this study, it is possible to observe that there was a difference in GI regarding the phonemic manipulation skills performance, when compared to the syllabic manipulation, thus, evidencing the difference between the performance in the metaphonological tasks. These findings suggest that, due to greater complexity involved in the phoneme manipulation, students with ADHD have difficulties in retaining information which require more accurate attention and concentration time^{4,7,24}.

In the comparison between groups, GII mean of errors was lower than that of GI for skills concerning final phoneme identification, phoneme subtraction, syllable addition and phonemes, syllable substitution and phoneme segmentation skills. The identification and manipulation skills of phonemes are considered as complex, since the student is required to perform two operations. Besides demanding greater attention to the stimulus, the student must retain and execute the requested instruction, organize and plan the response, besides retrieving the information stored for some time in his/her memory^{25,34-36}.

Thus, the performance of students with ADHD in metalinguistic skills tests was influenced by characteristic factors of this diagnosis, such as lack of organization, attention deficit and work memory deficit, which affect, direct and negatively, the retention of information, hampering the auditory information process^{18,22,24,25}. This fact is consistent with previous studies^{15,20,23,24} which indicate that students with ADHD present impairments concerning language, especially in the phonological and syntactic aspects. Therefore, it is believed that

the difficulties concerning these aspects are possibly caused by the attention deficit and the difficulty of inhibiting the non-relevant stimuli, in detriment of probable difficulties handling the linguistic aspects. When considering ADHD diagnosis, it becomes important to highlight the factors which interfere in the metalinguistic tasks performance, such as attention deficit, behavioral maladaptation, difficulties in following instructions and the necessity of longer periods to complete tasks^{30,35}.

Regarding the performance in reading tests - real words and non-words - the performance of GI was inferior than that of GII. Previous studies^{22,25,37} have reported that reading disorders comprising students with ADHD are derived from deficits in sequential, temporal, and attention deficit organization, since words decoding requires attention and self-regulation. Therefore, the reading deficit of these students constitutes a secondary consequence of self-regulation problems and attention inherent to ADHD^{15,25,30}.

In relation to non-word repetition tests, according to data from this study, it can be observed that GI students' performance is inferior for longer words, as compared to that of the control group. Previous studies^{17,24,38} attributed changes in perception and organization of acoustic stimuli not to a primary deficit, but to the hypothesis that children with ADHD present these changes as a phenomenon secondary to inattention. Therefore, deficit in sequential and temporal organization of the phonemes and difficulty to retain, in the memory, words with longer segments, can be justified by the phonological work memory deficit^{21,24,38}.

In the reading comprehension tests, no difference was seen between the performance of students

with ADHD and that of students with good academic performance. According to the classification criteria of the procedure applied, PROCOMLE³³, the students included in this study, both, GI and GII, presented inferior performance in expository texts and narrative texts. These findings suggest that students with ADHD were able to recall key information to perform basic comprehension of the read content^{39,40}. However, since both groups presented low scores, lack of reading comprehension is evident among schoolchildren, with and without ADHD, suggesting that the current literacy methodology, in our country, does not focus on teaching strategies for reading comprehension development in the classroom.

At the end of this study, it becomes necessary to consider further analysis of the performance profile in the metalinguistic and reading comprehension skills in students with ADHD, since the sample size does not allow generalization of the data, constituting some shortcomings of this study.

CONCLUSION

ADHD is more common in infancy, constituting a neurobiological condition which affects some learning areas. As observed in this study, students with this disorder presented greater number of errors in identification and manipulation of phonemes, repetition of non-words of larger extension and reading of words and non-words. In the reading comprehension test, both groups presented inferior performance, not presenting a statistically significant difference between the population of this study, leading us to reflect about the teaching conditions, in relation to reading comprehension, in the school context.

SPECIAL THANKS

To Coordination for the Improvement of Higher Education Personnel (Capes) for granting the scholarship which supported the research.

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