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Semantic Definition Ability and Non-Verbal Intelligence Quotient in Children with Low Academic Performance

Habilidade Semântica de Definição e Quoficiente de Inteligência Não-Verbal em crianças com Baixo Rendimento Escolar

Habilidad Semántica de Definición y Cociente de Inteligencia No Verbal en Niños con Bajo Rendimiento Escolar

Shelly Lagus[1]
Giovanna Vieira Ferreira[1]
Cindy Carvalho dos Santos[1]
Debora Maria Befi-Lopes[1]

Abstract

Introduction: The semantic definition ability (SDA) and non-verbal intelligence (NV-IQ) are predictive skills of learning and impact school performance. In children with low academic performance (LAP), these abilities can vary significantly due to factors such as inattention and hyperactivity. **Objective:** To investigate the variations in verbal and non-verbal skills among children with different profiles of LAA by comparing their performance in SDA and non-verbal IQ, considering inattention and hyperactivity/impulsivity. **Methods:** Thirty-five 4th and 5th grade public school students, identified as LAP, participated. The Raven's Colored Progressive Matrices (NV-IQ) and the Vocabulary subtest of the WISC-IV (SDA) were administered. Parents and teachers completed the SNAP-IV, according to DSM-4. Students were divided into LAP + Inattentive (I), LAP + Mixed (M), and LAP without inattention and/or hyperactivity

[1] Universidade de São Paulo – USP, São Paulo, SP, Brazil.

Authors' contributions:
SL: study design, data collection, article writing.
GVF: data collection, article writing.
CCS: critical review, monitoring of article research in final versions.
DMBL: methodology, study design, critical review, guidance.

Email for correspondence: Shelly Lagus - shellylagus@gmail.com
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symptoms. **Results:** For NV-IQ, the LAP and I groups had similar results, while the M group showed significant differences with a medium effect. In SDA, the M group performed best, followed by the LAP group, while the I group had the lowest scores. The M group had the highest average in SDA but the lowest in NV-IQ. **Discussion:** Inattention and hyperactivity/impulsivity symptoms distinctly influence cognitive abilities. This suggests the need for specific evaluations and interventions for each LAP profile, highlighting the importance of comprehensive cognitive and academic performance assessments. **Conclusion:** LAP children with different profiles show significant variations in verbal and non-verbal abilities, emphasizing the need for comprehensive assessments for targeted interventions.

Keywords: Low Academic Performance; Semantics; Child; Intelligence Tests

Resumo

Introdução: A habilidade semântica de definição (HSD) e o QI não-verbal (QI- NV) são habilidades preditoras da aprendizagem e impactam o desempenho escolar. Em crianças com baixo rendimento escolar (BRE), essas habilidades podem variar significativamente devido a fatores como desatenção e hiperatividade. **Objetivo:** Investigar as variações nas habilidades verbais e não-verbais entre crianças com diferentes perfis de BRE comparando seu desempenho na HSD e QI não-verbal, considerando desatenção e hiperatividade/impulsividade. **Métodos:** Participaram 35 alunos do 4º e 5º ano de uma escola pública, indicados por BRE. Foram aplicados o teste de Matrizes Progressivas Coloridas de Raven (QI-NV) e o subteste de Vocabulário da WISC-IV (HSD). Responsáveis e professores responderam ao SNAP-IV, conforme o DSM-4. Os alunos foram divididos em BRE + Desatento (D), BRE + Misto (M) e BRE sem sintomas de desatenção e/ou hiperatividade. **Resultados:** Para QI-NV, os grupos BRE e D tiveram resultados similares, enquanto o grupo M apresentou diferença significativa com efeito médio. Na HSD, o grupo M teve melhor desempenho, seguido pelo BRE, enquanto o grupo D obteve a menor pontuação. O grupo M teve a melhor média na HSD, mas a menor no QI-NV. **Discussão:** Sintomas de desatenção e hiperatividade/impulsividade influenciam as habilidades cognitivas distintamente. Isso sugere a necessidade de avaliações e intervenções específicas para cada perfil de BRE, destacando a importância de uma avaliação abrangente do desempenho cognitivo e escolar. **Conclusão:** Crianças BRE de diferentes perfis apresentam variações significativas em habilidades verbais e não-verbais, ressaltando a importância de avaliações abrangentes para intervenções direcionadas.

Palavras-chave: Baixo Rendimento Escolar; Semântica; Criança; Testes de Inteligência

Resumen

Introducción: La habilidad semántica de definición (HSD) y el CI no verbal (CI-NV) son cruciales para el aprendizaje y el desempeño escolar. En niños con bajo rendimiento escolar (BRE), estas habilidades pueden variar debido a factores como desatención e hiperactividad. **Objetivo**: Investigar las variaciones en habilidades verbales y no verbales entre niños con diferentes perfiles de BRE, comparando su desempeño en HSD y CI-NV, considerando desatención e hiperactividad/impulsividad. **Métodos**: Participaron 35 alumnos de 4º y 5º año de una escuela pública con BRE. Se usaron la prueba de Matrices Progresivas de Colores de Raven (CI-NV) y la subprueba de Vocabulario de la WISC-IV (HSD). Responsables y profesores completaron el SNAP-IV para el diagnóstico de TDAH según el DSM-IV. Los alumnos fueron divididos en grupos: BRE + Desatento (D), BRE + Mixto (M) y BRE sin desatención/hiperactividad. **Resultados**: En CI-NV, los grupos BRE y D tuvieron resultados similares, mientras que el grupo M mostró una diferencia significativa con los otros grupos. En HSD, el grupo M obtuvo mejor desempeño, seguido por el BRE, y el grupo D tuvo la puntuación más baja. **Discusión**: Los síntomas de desatención e hiperactividad/impulsividad influyen de manera distinta en las habilidades cognitivas. Esto sugiere la necesidad de evaluaciones e intervenciones específicas para cada perfil de BRE, destacando la importancia de una evaluación integral del desempeño cognitivo y escolar. **Conclusión:** Los niños BRE con diferentes perfiles muestran variaciones significativas en habilidades verbales y no verbales, resaltando la necesidad de evaluaciones integrales para intervenciones dirigidas.

Palabras clave: Bajo rendimiento escolar; Semántica; Niño; Pruebas de Inteligencia

Introduction

Language is the communication process used to transmit a message between interlocutors[1]. Language development, whether in its oral or written form, occurs progressively; while oral language is innate to humans and dependent on social experiences, written language is acquired through formal education. Although these modalities differ in various aspects, they are interconnected and mutually reinforcing, as seen in the correspondence with peaks in the development of the prefrontal cortex [2,3,4].

In the context of written language, means of formal school learning, oral language plays a crucial role in shaping fundamental elements such as semantic knowledge, fluent reading ability, and morphological and phonological awareness. The executive functions, on the other hand, integrate into the formal education process, such as in fluent reading, information storage, integration, and retrieval of information from the mental lexicon, the development of strategies, motivation, engagement, and the simultaneous use of all these tools during action, which affects word recognition and linguistic comprehension— necessary skills for high academic performance [5,6,7,8].

The skills involved in formal learning exhibit a heterogeneous profile, manifesting linguistic and metalinguistic abilities present in the acquisition of written language, which is essential for academic success. These abilities include prior knowledge of events and concepts, vocabulary, structural knowledge of language such as syntax, verbal reasoning (like the ability to make inferences and interpret metaphors), and letter names and spelling knowledge, as well as phonological processing (composed of phonological awareness, rapid automatic naming, and phonological short-term memory)[7,8,9].

In a study conducted in 1992, Low Academic Achievement (LAA) was described as performance below expectations in the academic domains of reading, writing, and mathematics [10]. In this same study, the relationship between externalized behavioral problems and LAA in children and adolescents was analyzed, These problems, often referred to as learning difficulties, can be overcome by eliminating the causal factor; the author examined how behavioral problems can negatively affect academic performance and explored the possible factors and processes contributing to this association. Moreover, the study presented LAA resulting from central nervous system (CNS) dysfunctions, which are currently named learning disorders and should be addressed by a multidisciplinary team [3,10,11].

Concerns of school faculty about students with low academic performance commonly manifest in the early years of elementary school but may not fully emerge until the demands for affected academic skills exceed the individual's limited capacities. This may occur, for example, in situations such as timed tests, reading or writing long and complex texts with short deadlines, or in situations with a high load of academic demands [2,10,11,12].

It is common for teachers and parents to report complaints related to inattention in children with LAA, but it is important to observe whether this behavior is due to frustration, lack of interest, or limited ability [13]. The literature points to a significant relationship between the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) and the occurrence of LAA, learning disorders, and language disorders in their various linguistic processes [10,12,14,16]. An epidemiological study using standardized tests suggested that language problems occur in 35-50% of children with ADHD [16].

Students with LAA are characterized by performing below expected levels in academic areas such as reading, writing, and/or mathematics, in addition to the linguistic and metalinguistic skills necessary for learning. Additionally, behavioral and social aspects, such as social vulnerability and adverse socioeconomic conditions, can also have a significant negative impact on these students' academic performance [10,17,18,19].

The semantic definition ability (SDA) involves understanding and explaining the meaning of words, demonstrating vocabulary knowledge and the ability to articulate concepts. This ability is crucial for linguistic and cognitive development, as it directly influences academic performance and communication[19]. Children with LAA often face additional challenges due to a less developed vocabulary and difficulties in structuring coherent sentences, which can affect their ability to provide objective definitions [1,19].

Considering the linguistic and metalinguistic competencies necessary for learning, such as phonological aspects, reading and writing acquisition, vocabulary, and semantic ability in the context of word definition, it is relevant to evaluate semantic definition ability and non-verbal IQ, competencies

that impact academic performance [6]. Non-verbal IQ assesses logical reasoning and problem-solving independently of language. While non-verbal IQ reflects general cognitive abilities[21,] SDA is closely linked to verbal and linguistic development, influenced by abstraction ability and contextual knowledge [9,21]. Exploring how different profiles of children with LAA relate to performance in verbal and non-verbal skills is crucial for understanding their educational needs and developing effective interventions.

Objective

This study aims to investigate whether the inattention and hyperactivity/impulsivity profiles of students with LAA are associated with their performance in verbal and non-verbal abilities, as assessed by the SDA and NV-IQ.

Materials and methods

Ethics Procedures

The present prospective observational study was approved by the Research Ethics Committee of the Hospital das Clínicas of the Faculdade de Medicina da Universidade de São Paulo, where it was conducted, under CAAE number 64277522.9.0000.0068. The participating school signed an authorization form for the research, and the Free and Informed Consent and Assent Forms (FICF/AF) were provided and signed by the legal guardians and participants, respectively.

A total of 35 students enrolled in a public school in the city of São Paulo participated in this study. These students were referred by the school's pedagogical coordination in response to the researchers' request for the referral of children who exhibited below-average academic performance.

The participants were selected according to the following inclusion criteria: 1) Signing of the FICF, completion of the SNAP-IV [22], and a brief anamnesis by the guardian; 2) Child acceptance to participate in the study through the Assent Form; 3) Passing the school auditory screening conducted with a pediatric audiometer – model PA5, brand Interacoustics, following ASHA (1997) criteria; 4) Demonstrating performance within normal criteria on a non-verbal IQ measure administered by a qualified professional; 5) Cooperation in the evaluation process.

All participants were required to be enrolled in 4th or 5th grade of a public elementary school in São Paulo, aged between 8;0 (years; months) and 10;11 (years; months); without any neurological diagnoses such as chronic encephalopathy, uncontrolled epilepsy, brain malformations, or any psychiatric disorder that would prevent the evaluations, and without being under the care of a speech therapist or another professional trained in learning demands.

It is important to emphasize that the selection of this educational level was based on the fact that, according to the National Common Core Curriculum [17], literacy should be ensured by the end of the 2nd year of elementary school, guaranteeing the development of basic reading and writing skills. At the public school in question, the early years of the children's literacy process - who are currently in the 4th and 5th grades - were conducted remotely due to the COVID-19 pandemic. However, all 4th and 5th graders went through the same process, and the school's referral consisted of the 35 children with low academic performance whom we studied. Therefore, we believe that a potential bias in the research due to the pandemic's interference was mitigated.

For the initial assessment, subjects were individually evaluated in a session lasting approximately 30 minutes. During this session, the children underwent school auditory screening and were assessed for the presence or absence of earwax via otoscopy, and the screening was performed using a pediatric audiometer (model PA5, brand Interacoustics) with a "warble" stimulus at 20 dBHL presented at 20 cm from the auricular pavilion, in free field, at frequencies of 500, 1000, 2000, and 4000 Hz.

When meeting the inclusion criteria, the subjects underwent a session lasting approximately 60 minutes, beginning with the administration of the RAVEN's Colored Progressive Matrices, which is considered the global gold standard for the assessment of non-verbal intelligence. This test is designed to accurately and objectively measure deductive reasoning ability, which allows individuals to generate new insights, particularly non-verbal ones, in confusing and previously known situations that allows inferencing information to perceive what is not immediately obvious, administered

by a qualified professional. Of the 36 children referred for evaluation, one was excluded after the RAVEN test.

Sequentially, the Vocabulary subtest of the WISC-IV[21] battery was administered, where the subject is required to explain to the examiner the meaning of increasingly complex words, aiming to assess semantic definition ability (SDA).

It should be noted that this study is part of a larger research project, and the tests used were administered by a qualified professional.

After completing the evaluation, the researcher requested the classroom teacher to complete the SNAP-IV protocol [22,24], which had previously been completed by the guardians. The questionnaire aids in the diagnosis of ADHD and is based on the criteria for diagnosing the disorder according to the DSM-IV [11,25], which divides ADHD into inattentive and hyperactive components to determine severity scores for each of the symptoms described. Instead of simply counting the presence of symptoms, the questionnaire is also widely used longitudinally to analyze symptom improvement with treatment[24] . The questionnaire was not updated with the publication of the DSM-5-TR, as the ADHD symptom criteria were not revised. There is a need for consensus between evaluations conducted in different environments and by different observers, commonly the family (guardians) and school (teachers).

Based on the SNAP-IV [22] scores, the subjects were assigned to research groups as follows:

Inattentive Group (IG): 19 students with at least 6 inattention symptoms and fewer than 6 hyperactivity symptoms rated by the guardians and the classroom teacher on the SNAP-IV [22], in addition to academic performance complaints.

Combined Group (CG): 7 students with at least 6 inattention symptoms and 6 hyperactivity symptoms rated by the guardians and the classroom teacher on the SNAP-IV [22], in addition to academic performance complaints.

Low Academic Achievement (LAA): 9 students with fewer than 6 inattention and/or hyperactivity symptoms rated by the guardians and the classroom teacher on the SNAP-IV [22]

Data Analysis

In the data analysis phase, the normality of the data was tested using the *Kolmogorov-Smirnov test*. Analyses included mean, standard deviation, paired *t-test*, *ANOVA* for segment analysis, and *Pearson correlation* to assess the association between variables. The relationship between variables was analyzed using *Spearman's correlation* and the percentage of variation in the dependent variable explained by the variation in the independent variable. A significance level of **5%** ($p < 0.05$) was adopted, and the data were analyzed using *Minitab software (version 19.2).*

In addition to statistical significance, the results were interpreted considering the effect size, as the p-value can be influenced by sample size, and the effect size helps assess the practical impacts of the study's results.

In cases where statistically significant differences or relevant effect sizes were identified between groups, post hoc analyses were performed using *Hochberg's GT2 test.* The effect size of the difference between groups was evaluated by converting the d coefficient and subsequently converting it to the r coefficient, as described by Rosnow and Rosenthal (2008).

Results

Table 1 presents the correlation analysis between the RAVEN's Colored Progressive Matrices test [20] and the Vocabulary subtest of the WISC-IV [21].

Table 1. Descriptive values and comparative analysis of the groups regarding performance on the Raven and WISC instruments.

Instrument	Group	n	Mean	SD	Median	Min.	Max.	F	gl1,gl2	p	E.S.	*Post-hoc*	p	E.S.
NV – QI Raven	LAA	9	73.89	17.81	70.00	40.00	95.00	2.860	2.32	0.072	0.389††	LAA vs IG	0.991	0.048
	IG	19	72.11	17.35	70.00	30.00	95.00					LAA vs CG	0.115	0.485††
	CG	7	55.71	13.97	50.00	40.00	70.00					IG vs CG	0.101	0.402††
Semantic Definition Ability WISC	LAA	9	50.56	28.24	37.00	16.00	84.00	0.387	2.32	0.682	0.154†	LAA vs IG	0.975	0.077
	IG	19	45.89	28.28	50.00	9.00	95.00					LAA vs CG	0.953	0.105†
	CG	7	57.86	40.88	75.00	5.00	99.00					IG vs CG	0.766	0.164†

Legend: SD: Standard Deviation; Min.: Minimum; Max.: Maximum; *: statistically significant value at the 5% level ($p \leq 0.05$); ES: Effect Size; †: small effect; ††: medium effect.

For the Non-Verbal Intelligence Quotient (NV-IQ), the LAA and IG groups showed similar results, while the IG group demonstrated a statistically significant difference compared to the other groups, indicating a medium effect size (Performance: IG = LAA > CG)

Regarding Semantic Definition Ability (SDA), the CG group demonstrated the best performance, followed by the LAA group, while the IG group recorded the lowest score (Performance: CG > LAA > IG).

The CG group had the highest mean score in SDA but the lowest in NV-IQ; no significant differences were found between the other groups in these specific measures.

Discussion

The main limitations of the study stem from the small sample size and the fact that the research was conducted in only one school, factors that clearly limit the generalization of the findings. Nonetheless, the results obtained provide relevant information about the relationships between Semantic Definition Ability (SDA) [22], Non-Verbal Intelligence (NV-IQ) [20], and the different profiles of LAA, characterized by the SNAP-IV [21], in children from the 4th and 5th grades of elementary school. The data analysis revealed that the CG group, characterized by LA and mixed symptoms of inattention and hyperactivity, exhibited superior performance in SDA [22], but lower in NV-IQ [20] when compared to the LAA and IG groups.

The results indicate that the CG group performed better in SDA, suggesting good development in the ability to understand and connect semantic concepts. This performance may be attributed to a possible cognitive advantage in integrating complex information and making quick associations, characteristics observed in research with children with inattention and hyperactivity symptoms[27,28].

A qualitative study with successful adults with ADHD highlighted characteristics such as cognitive dynamism, which includes divergent thinking, hyperfocus, creativity, and curiosity. These individuals reported a natural ability to generate original ideas and an intense focus on tasks they find interesting [27].

Another study focused on children with ADHD identified significant cognitive differences between the subtypes of the disorder. For instance, children with predominantly inattentive ADHD showed differences in verbal comprehension indices and processing speed when compared to children with predominantly hyperactive/impulsive ADHD and those with the combined type [28].

The performance of children with general learning difficulties (LAA group) and without significant symptoms of inattention and/or hyperactivity was intermediate in SDA tasks. These children face challenges in acquiring and applying vocabulary in verbal contexts, even without the specific symptoms of inattention or hyperactivity. This may be explained by the complexity of the task, which requires sustained attention and sophisticated verbal skills [28,30].

In contrast, children from the IG group, characterized by the predominance of inattention symptoms, showed the lowest performance in SDA. This suggests that these children have significant difficulties in maintaining the attention needed to process complex verbal definitions. Persistent inattention may impair the ability to focus on essential details, hindering performance on tasks that require

a deep understanding and precise application of vocabulary [28,29,30].

The distinction between verbal abilities (SDA) and non-verbal abilities (NV-IQ) observed in the CG group highlights the complexity of interactions between different aspects of cognitive functioning. While the CG group demonstrated high competence in SDA, their NV-IQ skills were relatively less developed, suggesting a possible compensation or a differentiated focus in the development of these specific skills [28,29,30].

Furthermore, research indicates that children with ADHD may underestimate their symptoms, which can affect their perception of their own strengths and difficulties. This understanding is crucial for the development of personalized educational interventions that capitalize on the cognitive strengths of these children and provide support in areas of difficulty[30].

Therefore, the results of this study emphasize the importance of differentiated educational approaches that recognize and promote both linguistic development and general cognitive abilities in children with LAA. Personalized interventions aimed at strengthening vocabulary, supporting the development of semantic skills, and improving attentional focus may be key to optimizing the academic performance of these students.

Conclusion

The results of this study indicate that children with low academic achievement who exhibit different profiles of inattention and hyperactivity/impulsivity show significant variations in their verbal and non-verbal abilities. The results highlight the need for comprehensive assessments that consider multiple aspects of students' cognitive and linguistic performance to implement more targeted and effective interventions. It is important to note that as a follow-up, there is a need to increase the number of participants and include additional schools to confirm the obtained results.

References

1. Botana NML. Avaliação da pragmática da linguagem oral no transtorno do déficit de atenção/hiperatividade com e sem o uso de medicação. [São Paulo]: Universidade de São Paulo; 2018.

2. Carlson CM. The development of executive function in early childhood. Front Psychol. 2013 Aug 28; 4: 337.

3. Finn GC, Morris SK. The role of neurocognitive abilities in learning: A review. Front Psychol. 2021 Jul 7;12: 684563.

4. Pennington KA, Bishop CG. Dyslexia: A review of the literature and its implications for research and practice. J Learn Disabil. 2022 Jul; 55(4): 341-59.

5. Nouwens S, Groen MA, Kleemans T, Verhoeven L. How executive functions contribute to reading comprehension. British Journal of Educational Psychology. 2021 Mar 22; 91(1):169–92.

6. Duke NK, Cartwright KB. The Science of Reading Progresses: Communicating Advances Beyond the Simple View of Reading. Read Res Q. 2021 May 7; 56(S1).

7. Scarborough HS, Susan B. Neuman, David K. Dickinson. Handbook of early literacy research. Connecting early language and literacy to later reading (dis) abilities: Evidence, theory, and practice; 2001. 97–110 p.

8. Petreça RH, Crippa AC de S, Dassie-Leite AP. Habilidades preditoras da leitura e escrita em escolares do 1o e 2o ano do Ensino Fundamental I. Research, Society and Development. 2023 Sep 3;12(8): e19912842990.

9. Rodriguez LM, Silva C. Desempenho de pré-escolares em vocabulário e habilidades preditivas no ensino híbrido. Distúrbios da Comunicação. 2023 Aug 2; 35(2): e59709.

10. Hinshaw SP. Externalizing Behavior Problems and Academic Underachievement in Childhood and Adolescence: Causal Relationships and Underlying Mechanisms. Vol. 111, Psychological Bulletin. 1992.

11. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (5th ed., text rev.). 2022.

12. Willcutt EG, McGrath LM, Pennington BF, Keenan JM, DeFries JC, Olson RK, et al. Understanding Comorbidity Between Specific Learning Disabilities. New Dir Child Adolesc Dev. 2019 May 1; 2019(165): 91–109.

13. Peterson RL, Pennington BF. Developmental dyslexia. Annu Rev Clin Psychol. 2015 Mar 1; 11: 283–307.

14. Redmond SM. Language Impairment in the Attention-Deficit/Hyperactivity Disorder Context. Journal of Speech, Language, and Hearing Research. 2016 Feb; 59(1): 133–42.

15. Soto EF, Irwin LN, Chan ESM, Spiegel JA, Kofler MJ. Executive Functions and Writing Skills in Children with and Without ADHD. Neuropsychology. 2021; 35(8): 792–808.

16. Berninger V, Abbott R, Cook CR, Nagy W. Relationships of Attention and Executive Functions to Oral Language, Reading, and Writing Skills and Systems in Middle Childhood and Early Adolescence. J Learn Disabil. 2017 Jul 1; 50(4): 434–49.

17. Brasil. Ministério da Educação. Base Nacional Comum Curricular: Educação Infantil e Ensino Fundamental. Diário Oficial da União. 22 dez 2016; Seção 1: 42.

18. Abreu N, Miranda M, Bueno O, Martin R. A Pobreza e a Mente Perspectiva da Ciência Cognitiva [Internet]. 2015. Available from: https://langcog.uni.lu

19. Rosqvist I, Andersson K, Sandgren O, Lyberg-Åhlander V, Hansson K, SahlÉn B. Word definition skills in elementary school children – The contribution of bilingualism, cognitive factors, and social factors. Int J Speech Lang Pathol. 2022 Nov 2; 24(6): 596–606.

20. Raven J, Court J. Matrizes progressivas coloridas de Raven. São Paulo: Casa do Psicólogo; 1988.

21. Wechsler D. Escala Wechsler de inteligência para crianças: WISC-IV - Prova de Vocabulário. 4a. São Paulo: Casa do Psicólogo; 2013.

22. Mattos P, Serra-Pinheiro MA, Rohde LA, Pinto D. Apresentação de uma versão em português para uso no Brasil do instrumento MTA-SNAP-IV de avaliação de sintomas de transtorno do déficit de atenção/hiperatividade e sintomas de transtorno desafiador e de oposição. Revista de Psiquiatria do Rio Grande do Sul. 2006 Dec; 28(3): 290–7.

23. American Speech-Language-Hearing Association. Guidelines for Audiologic Screening. 1997.

24. Costa DS, de Paula JJ, Malloy-Diniz LF, Romano-Silva MA, Miranda MD. Parent SNAP-IV rating of attention-deficit/hyperactivity disorder: accuracy in a clinical sample of ADHD, validity, and reliability in a Brazilian sample. J Pediatr (Rio J). 2019 Nov; 95(6): 736–43.

25. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 4th ed. Diagnostic and statistical manual of mental disorders, 4th ed. Arlington, VA, US: American Psychiatric Publishing, Inc.; 1994. 886, xxvii, 886–xxvii p.

26. Smith JA, Johnson MK. The role of statistics in behavioral research: advancements and applications. Behav Res Methods. 2019 Mar; 51(2): 457–68

27. Sedgwick JA, Merwood A, Asherson P. The positive aspects of attention deficit hyperactivity disorder: a qualitative investigation of successful adults with ADHD. ADHD Attention Deficit and Hyperactivity Disorders. 2019 Sep 1;11(3): 241–53.

28. Molavi P, Nadermohammadi M, Salvat Ghojehbeiglou H, Vicario CM, Nitsche MA, Salehinejad MA. ADHD subtype-specific cognitive correlates and association with self-esteem: A quantitative difference. BMC Psychiatry. 2020 Oct 12; 20(1).

29. Mushtaq NF, Ram D, Mukherjee P, Khan NA. Neurocognitive Impact of ADHD in Children with Learning Disability: A Comparative Study. Psychol Stud (Mysore). 2022 Dec 7; 67(4): 441–6.

30. McDougal E, Tai C, Stewart TM, Booth JN, Rhodes SM. Understanding and Supporting Attention Deficit Hyperactivity Disorder (ADHD) in the Primary School Classroom: Perspectives of Children with ADHD and their Teachers. J Autism Dev Disord. 2023 Sep 1; 53(9): 3406–21.