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Executive functions and sentence comprehension in children with ADHD, DLD, and comorbid ADHD and DLD

Le funzioni esecutive e la comprensione delle frasi nei bambini con ADHD, DLD e ADHD e DLD comorbili

Fuori Call

Present cohort study assessed sentence comprehension and three domains of executive functions (EF) - inhibition, cognitive flexibility, and working memory in groups of children with DLD, ADHD, and comorbid DLD + ADHD. EF were assessed using the parental Behaviour Rating Inventory of Executive Function and comprehension skills by Sentence Comprehension Test (TEPO). A clinical sample of 114 children, aged 6-8 years, participated in the study. TEPO T-score values were significantly different between almost all groups. Additionally, parents of children with ADHD and comorbid ADHD and DLD reported higher scores of their children's difficulties in the three EF assessed, while parents of children with DLD reported lower scores of EF difficulties. The current study offers a unique perspective on executive functioning and sentence comprehension in children with comorbid DLD and ADHD.

Keywords: DLD; ADHD; Inhibition; Cognitive Flexibility; Working Memory

Il presente studio di coorte ha valutato la comprensione delle frasi e tre domini delle funzioni esecutive (EF) - inibizione, flessibilità cognitiva e memoria di lavoro - in gruppi di bambini con DLD, ADHD e DLD + ADHD comorbili. Le EF sono state valutate mediante l'impiego del Behaviour Rating Inventory of Executive Function dei genitori e delle capacità di comprensione mediante il Sentence Comprehension Test (TEPO). Lo studio ha coinvolto un campione clinico di 114 bambini di età compresa tra 6 e 8 anni. I valori del punteggio t del TEPO risultavano significativamente diversi tra quasi tutti i gruppi. Inoltre, i genitori dei bambini con ADHD e ADHD con DLD comorbili hanno riportato punteggi più elevati nelle difficoltà dei loro figli nelle tre EF esaminate, mentre i genitori dei bambini con DLD hanno riportato punteggi più bassi nelle difficoltà delle EF. Il presente studio fornisce una prospettiva unica sul funzionamento esecutivo e sulla comprensione delle frasi nei bambini con DLD e ADHD comorbili.

Parole chiave: DLD; ADHD; Inibizione; Flessibilità Cognitiva; Memoria di Lavoro

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Attention Deficit Hyperactivity Disorder and Developmental Language Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most diagnosed neurodevelopmental disorders in childhood and adolescence. The prevalence of the disorder was 7 % in 2023 (Chaulagain et al., 2023). Children with ADHD have difficulties primarily in the area of Executive Functions (EF), although a large number of scientific evidence suggests these children also have difficulties in the language area, such as comprehension (Korrel et al., 2017), expressive production and semantics (Helland et al., 2014), and morphosyntax (Stanford & Delage, 2020). These difficulties are often less pronounced than in children with Developmental Language Disorder.

Developmental Language Disorder (DLD) is the second most diagnosed disorder among developmental speech or language disorders, with a prevalence of 7.58 % in children (Norbury et al., 2016). Traditionally, many authors focused on the language acquisition difficulties of these children. Analyses of comprehension ability, phonology, semantics, morphosyntax and pragmatics are of primary focus (Bishop et al., 2017). Recently, increased attention has been paid to the area of cognitive and executive functions and their influence on the development of *structural language skills*. For instance, Bishop et al. (2017) suggest non-linguistic factors such as the EF may contribute to difficulties in language acquisition in DLD. Children with DLD have been described to perform lower than typically developing children in various cognitive domains and EF such as procedural learning (Nicolson & Fawcett, 2007), processing speed, and short-term memory (STM) and working memory (WM) (Kapa et al., 2017; Willinger et al., 2017), sustained selective attention (Kapa et al., 2017), attentional shifting (Aljahlan & Spaulding, 2019), inhibitory control (Kapa et al., 2017), cognitive flexibility, problem solving and planning (Pauls & Archibald, 2016).

Comorbid prevalence of ADHD and DLD is reported to be 20-30 % (Parks et al., 2023) and there is a significant overlap of symptoms between ADHD and DLD (Parks et al., 2024) resulting in numerous challenges for school-based speech and language pathologists in both diagnostics and therapy (Aldakroury, 2018).

Executive functions

EF as a set of general-purpose control mechanism include control of emotions and impulses, attention shifting, cognitive flexibility, working memory, self-monitoring, planning and prioritizing, initiating action, and organizing activities. Understanding the relationship between EF and linguistic difficulties in children with DLD and ADHD has recently received increased attention in international research, however, the area of sentence comprehension in relation to EF has not yet been sufficiently explored.

Diamond (2013) demonstrated that inhibition, cognitive flexibility and working memory are developmentally younger and are the prerequisites for later development of higher-level EF (reasoning, problem-solving and planning). The specific executive functions shall be investigated further as they form the basis for the present study.

Firstly, according to Fosco et al., (2019) inhibitory control has long been considered a central neurocognitive process in ADHD. Difficulties in inhibitory processes, i.e., the ability to control attention, behaviour, thoughts and/or emotions according to the demands of the situation (Diamond, 2013), are most often investigated by speech and language therapist in relation to reading comprehension, and numerous studies show a clear relationship between these two domains. To date, only few studies examined correlations between inhibition and sentence comprehension. In studies by Larson et al. (2020) and Marini et al. (2020), children with DLD achieved significantly lower performance in inhibition. Larson and colleagues (2020) provide preliminary evidence for a predictive relationship between inhibition and later understanding of morphological structures in children with DLD. The authors note that the ability to inhibit develops slowly between the ages of seven and twelve.

Secondly, children with DLD show deficits in verbal short-term memory (STM), working memory (WM), and language long-term memory (LTM) compared to typically developing children of the same age (Ar-

chibald & Gathercole, 2007; Lum et al., 2014; Montgomery et al., 2021), and these deficits affect their ability to understand sentences (Montgomery et al., 2021). Children with ADHD do not show deficits in STM, but primarily in WM, which refers to the ability to store information in the short term memory when engaging in a mental activity (Kofler et al., 2018). Children with ADHD do not have difficulty recalling information from verbal memory but rather have difficulty storing information in LTM when presented orally, which will also affect their ability to understand sentences (Skodzik et al., 2018).

Finally, the last domain studied is cognitive flexibility. It is the ability to make adaptive and flexible choices between multiple incompatible object representations, perspectives or strategies in order to adapt to the demands of a situation (Diamond, 2013). This is the least explored area in relation to sentence comprehension. The correlation between narrative discourse comprehension and cognitive flexibility was evaluated in a study by (Dong et al., 2023) involving children with ADHD in the first year of school. The authors concluded that children with good CF skills reached higher levels of comprehension than children with difficulties in this area. An exploratory data analysis (Hund et al., 2023) showed that cognitive flexibility played a unique role in comprehension in older elementary school children but not in younger elementary school children.

EF are traditionally measured by standard neuropsychological tests such as the WISC-V (Wechsler, 2014). However, the use of these tests in ADHD children with executive dysfunction has been criticised as children who struggle in everyday life due to EF difficulties perform well on the diagnostic measures.

The traditional notion of a countrywide, unitary standardisation of an IQ test, also known as 'population-based norms', is also considered an unsatisfactory model for valid assessment practices in diverse cultural contexts (Shuttleworth-Edwards, 2016).

However, the use of these tests in ADHD children with executive dysfunction has been criticised as children who struggle in everyday life due to EF difficulties perform well on the diagnostic measures. A potential explanation is that the cognitive tasks included in these tests are presented in an attractive form, which increases children's motivation to complete these tasks, and are also undertaken in a quiet room without distractions. Since the difficulties of children with ADHD usually manifest themselves in a distracting environment full of uninteresting tasks, one might argue diagnostic measures are not ecologically valid (Toplak et al., 2013; Vriezen & Piggot, 2002).

Another option for evaluating executive functions is the use of standardized questionnaires completed by parents, teachers, or adolescents themselves. The advantage of these questionnaires is that they assess behaviour presented over a long time period and in different more or less structured environments (home or school). A systematic review by Cesari et al. (2024) reports frequent use of the BRIEF inventory (Gioia et al., 2000).

There is a considerable number of studies examining behavioural ratings of EF using the BRIEF inventory in children with ADHD, but not many have been published on DLD. The BRIEF inventory was used in preschool-aged children with DLD (Vugs et al. 2014; Wittke et al.,2013) and older children aged 5-12 years (Cuperus et al. 2014).

In all the studies, parents report more EF difficulties in children with DLD than in typically developing children. Cuperus and colleagues (2014) note that only very low correlations can be found when comparing the responses of parents and teachers in the BRIEF inventory.

For this study, it is therefore essential that we examine two variables (sentence comprehension and behavioural manifestations of executive functions in three domains), the severity of which is not usually fully recognised by parents.

Present study

To date, a number of studies have been devoted to investigating language skills in children with isolated ADHD or DLD however (Méndez-Freije, et al., 2023) propose a simultaneous study of both disorders to study the symptom overlap, i.e. include these children in one research group, which is not a common

practice in scientific studies. The outcomes in the diagnostics of language skills of children with ADHD and DLD are most commonly assessed in research studies and compared to typically developing children without accounting for the presence of comorbidities or subclinical difficulties in attention and language acquisition (Méndez-Freije, et al., 2023). Parks et al. (2023) highlight the need for further studies that also examine the outcomes of children with comorbid ADHD + DLD. There are not many studies examining sentence comprehension in children with ADHD and DLD simultaneously in a population of school aged children. Children aged 6-9 years which corresponded in age to the children included in this study were only included in a study by (Hutchinson et al., 2012).

The aim of the present study is to examine EF and sentence comprehension in children with ADHD, DLD, and comorbid ADHD and DLD.

Our specific research questions included:

- *Are there group differences in children´s TEPO test performances?*
- *Do parental ratings of EF (inhibition, cognitive flexibility, working memory) differ between the four basic groups?*

Method

Participants

A total of 114 school aged children, aged 6–8 years (M = 83.5 months, i.e. 6 years 11.5 months; 58 boys, 56 girls), participated in this study. Participants were recruited from three distinct regions in Moravia, the Czech Republic.

The following inclusion were listed on the recruitment flyers: (1) Czech as the mother tongue, (2) schooling started, (3) age 6-8 years, (4) intellect in the normal range (performance IQ > 84, (5) normal hearing and visual acuity, (6) absence of a specific neurological diagnosis (e.g. cerebral palsy, stroke, seizure disorder), (7) absence of significant behavioural problems that could interfere with the child's ability to be tested.

It should be noted that the children were not examined for the presence of externalizing, internalizing, or other disorders (e.g., developmental coordination disorders, dyslexia).

The data collection was performed between 2023 and 2024.

Participants were divided into 4 groups: DLD, ADHD, DLD + ADHD, and typically developing control group (TLD). Children were assigned to the individual groups if their diagnosis was confirmed by a clinical and psychometric assessment by a speech and language pathologist and psychologist.

In the Czech Republic, according to the Guidelines for DLD (Pospíšilová, 2022), a speech therapist must use at least three diagnostic tools in the diagnostic process during the child's school age. Detailed neuropsychological assessment by a paediatric clinical psychologist involved a comprehensive cognitive assessment. In this study was used Intelligence and Development Scales (IDS; Gorb, Meyer, Hagmann-von Arx, 2013) as a tool that assesses intelligence and executive functions, but also psychomotor skills, social-emotional skills, scholastic skills such as language or mathematical abilities, and motivation and attitude.

Assessment methods

All children in the study population were examined using the following methods: analysis of anamnestic data, interview with the parent and the child, tests to assess receptive and expressive aspects of language: the TEPO Sentence Comprehension Test (Solná & Červenková, 2022), OPAV Sentence Repetition (Smolík et al., 2018), TEPRO Vocabulary Production Test (Solná, 2022), Non-Words Repetition Test (Seidlová Mál-

ková & Smolík, 2014), and MAIN Multi-Language Test for the Assessment of Narrative Ability (Gagarina et al., 2019). The research population included children who scored below the deficit threshold in three of the above tests.

Parents completed the BRIEF – Parent Report, a standardized questionnaire (Gioia et al., 2000). All of the children included in the research sample had been diagnosed with ADHD by a child clinical psychologist. The BRIEF questionnaire was used to assess how parents perceived their children's difficulties in three core executive functions.

This study used the TEPO sentence comprehension test designed for children aged 3 to 8 years, which has a similar structure as the Test for Reception of Grammar – TROG-2 (Bishop, 2003) and measures children's ability to understand grammar structures in sentences. This test is currently the sole evaluation tool available in the Czech Republic for assessing comprehension of sentences with a focus on morpho-syntax.

It can be used to test the level of comprehension in children with neurodevelopmental disorders who are suspected of having a comprehension disorder. The child chooses one of four pictures that corresponds to the sentence that was read. A final score of ≤ 5th percentile is considered clinically significant and suggests a deficiency in sentence comprehension. This test has sufficient psychometric properties evaluated in two groups of children (TLD and DLD) – concurrent validity (rs = 0.826; rs = 0.863), internal validity (Cronbach's a = 95), sensitivity (82.4 – 100 %); specificity (87–100 %) (Solná & Červenková, 2022b).

The selection of the research population was deliberate, the children were divided into "boys" and "girls" based on their sex assigned at birth (AFAB: assigned female at birth; AMAB: assigned male at birth). The testing has been performed at the Hospital AGEL Ostrava Vítkovice.

The largest group was the group of children with developmental language disorder (DLD), which included 30 children (26.3 %), the ADHD group included 29 children (25.4 %), the group with a combination of DLD and ADHD included 28 children (24.6 %), and the control group (TLD) included 27 children (23.7 %).

Ethics

The research study that underpins this publication was approved by the Ethics Committee of Palacký University and conducted in accordance with principles of the Helsinki Declaration and the standards for Ethical Research Involving Children (ChildWatch International and UNICEF). Written informed consent was signed by primary caregivers.

Statistical analysis

The Shapiro-Wilk normality test was used to compare the groups. The median age in all groups was the same (83 months), with mean values in the DLD group being 82.2 months (SD 7.3, p = 0.073), ADHD 85.2 months (SD 6.0, p = 0.044), DLD+ADHD 83.1 months (SD 5.4, p = 0.058), and TLD 83.7 months (SD 7.2, p = 0.278). The age of children in groups did not show significant deviations from normality (p > 0.05). According to the Kruskal-Wallis test, there were no statistically significant differences between the age groups (p = 0.628).

In terms of gender distribution, the representation of gender in the DLD group was 53.3% of boys and 46.7% of girls. In the ADHD group, the distribution was 48.3 % of boys and 51.7 % of girls). In the DLD + ADHD group, 53.6% of boys and 46.4% of girls were included. In the TLD control group, 59.3%of girls prevailed over 40.7% of boys. A predominance of boys (50.9 %) compared to girls (49.1 %) occurred. However, a Chi-square test of independence showed no statistically significant associations between gender and a diagnosed disorder (p = 0.752).

The level of education of the child's mother and father was assessed separately.

We were interested in how many mothers had ≥12 years of education and how many had ≤12 years. In the DLD group (n=6; 20 %) mothers had ≥12 years of education. In the DLD+ADHD group, (n=5; 18%) mothers had ≥12 years of education. In the TLD group, (n=5; 17,2%) mothers had ≥12 years of education. In the ADHD group, (n=4; 15%) mothers had ≥12 years of education. A chi-squared test of independence showed no statistically significant association between education in mothers and a diagnosed disorder in children (p = 0.38). The socioeconomic status of families was not analysed.

Results

Question 1: Are there group differences in children´s TEPO test performances?

A deficit in sentence comprehension was found in 23 children with DLD (76.7%) and 10 children with DLD + ADHD (35.7%), but was not found in children with ADHD, or TLD.

Table 1 provides data on the relationship between diagnostic groups and results obtained in the TEPO test. The results of the TEPO test are presented in percentiles. The Shapiro-Wilk test was employed to assess the normality of data distribution within each group (TLD: W = 0.92, p = 0.04; ADHD: W = 0.94, p = 0.11; DLD: W = 0.82, p < 0.001 ; DLD+ADHD: W = 0.88, p = 0.003). As the majority of groups do not exhibit a normal distribution, non-parametric tests were employed in the subsequent analysis. In order to ascertain whether there were statistically significant differences between the groups, the Kruskal-Wallis test was employed, yielding a result of p < 0.001. The effect size, denoted by Eta², was found to be 0.63, which is considered to be a substantial effect size.

Table 1. TEPO results for the selected sample groups

		DLD	DLD + ADHD	ADHD	TLD	Total	P-value
TEPO	≤ 5. %ile	23 (76.7%)	10 (35.7%)	0 (0%)	0 (0%)	33 (28.9%)	<0.001*
	5-10. %ile	7 (23.3%)	10 (35.7%)	13 (44.8%)	2 (7.4%)	32 (28.1%)	
	>10. %ile	0 (0%)	8 (28.6%)	16 (55.2%)	25 (92.6%)	49 (43%)	
	Total	30 (100%)	28 (100%)	29 (100%)	27 (100%)	114 (100%)	

Note: TEPO percentiles: Values ≤ 5th %ile (percentile) indicate a clear deficit in comprehension, scores between the 5th and 10th percentile indicate a subnormal result, i.e. a possible deficit in sentence comprehension, and values above the 10th percentile indicate a normal result.
**There is a statistically significant relationship between groups and score at the α = 5% significance level.*

Consequently, substantial disparities emerge among the groups in their comprehension of sentences when employing the TEPO test, most notably between the TLD and DLD groups. The DLD group has obtained significantly lower results than all other groups. It has been demonstrated that children who present with a comorbid diagnosis of DLD and ADHD demonstrate superior performance in comparison to those with a diagnosis of DLD alone.

Question 2: Do parental ratings of EF (inhibition, cognitive flexibility, working memory) differ between the four basic groups?

Table 2 provides data on the relationship between diagnostic groups and results obtained in three scales of BRIEF. The results of the BRIEF scales are presented in T-scores. Fisher's exact test was used was used to analyse the relationships between groups and scores. There is a statistically significant difference between the groups and the level of achievement at the α = 5 % significance level for all groups of children. The effect size, denoted by Eta², was found to be 0.84, which is considered to be a substantial effect size.

Table 2. BRIEF subscales results (in T-scores) of the selected diagnostic groups

		DLD	DLD + ADHD	ADHD	TLD	Total	P-value
Inhibition	≤50	23 (76.7 %)	6 (21.4 %)	11 (37.9 %)	24 (88.9 %)	64 (56.1 %)	<0.001[1]*
	50 - 65	6 (20 %)	15 (53.6 %)	10 (34.5 %)	3 (11.1 %)	34 (29.8 %)	
	≥65	1 (3.3 %)	7 (25 %)	8 (27.6 %)	0 (0 %)	16 (14 %)	
	Total	30 (100 %)	28 (100 %)	29 (100 %)	27 (100 %)	114 (100 %)	
Cognitive flexibility	≤50	12 (40 %)	4 (14.3 %)	7 (24.1 %)	19 (70.4 %)	42 (36.8 %)	<0.001[1]*
	50 - 65	17 (56.7 %)	11 (39.3 %)	18 (62.1 %)	8 (29.6 %)	54 (47.4 %)	
	≥65	1 (3.3 %)	13 (46.4 %)	4 (13.8 %)	0 (0 %)	18 (15.8 %)	
	Total	30 (100 %)	28 (100 %)	29 (100 %)	27 (100 %)	114 (100 %)	
Working memory	≤50	22 (73.3 %)	4 (14.3 %)	3 (10.3 %)	22 (81.5 %)	51 (44.7 %)	<0.001*
	50 - 65	7 (23.3 %)	11 (39.3 %)	17 (58.6 %)	5 (18.5 %)	40 (35.1 %)	
	≥65	1 (3.3 %)	13 (46.4 %)	9 (31 %)	0 (0 %)	23 (20.2 %)	
	Total	30 (100 %)	28 (100 %)	29 (100 %)	27 (100 %)	114 (100 %)	

**There is a statistically significant relationship between groups and score at the α = 5% significance level; 1 Modified Fisher's exact test*

BRIEF T-scores: values ≥ 65 indicate the deficit band, values 50-65 indicate subnormal results, the risk band, and values ≤ 50 indicate a normal result.

When assessing the inhibition scale of the BRIEF inventory, the most significant difficulties were observed in the DLD+ADHD group and, to a lesser extent, in the ADHD group. The control group had significantly lower values, indicating better inhibitory abilities. An unexpected finding, however, is that parents of children with DLD did not report difficulties in this area.

When assessing the cognitive flexibility scale from the BRIEF inventory, only the DLD + ADHD and ADHD groups were found to be significantly different from the norm, with higher scores indicating more difficulty in this area. Other groups did not show significant deviations from the norm.

A similar trend was observed for the working memory scale. For DLD, the value was significantly lower, whereas for DLD + ADHD and ADHD it was higher. The control group was also significantly different, performing better than the norm.

Overall, the results showed that children with ADHD and comorbid DLD + ADHD scored significantly higher in the areas of EF (inhibition, attention shifting, working memory), thus indicating greater difficulties from the parents' point of view.

Discussion

The present study investigated a sentence comprehension in school-aged DLD, ADHD, and DLD +ADHD children and also executive functions (inhibition, cognitive flexibility and working memory) from parents perspective. Participating children were 6-8 years old as this age implies a greater differentiation of language profiles between the two basic diagnoses (Parks et al., 2023).

Results of the present study revealed children with DLD scored significantly lower in sentence comprehension compared to children in the other groups. Additionally, children with comorbid ADHD and DLD also scored below the norm. The results are in accordance with other studies, such as Cardy et al., 2010; Hutchinson et al., 2012; Jaworski, 1996; McInnes et al., 2003. However, children with ADHD did not obtain lower scores in sentence comprehension, which was inconsistent with the results of previously conducted studies (e.g. Wassenberg et al., 2010).

There are several possible explanations. The results of each study should be interpreted with respect to the age of children, with consideration of the presence of comorbid DLD+ADHD, with respect to the frequency of occurrence of each subtype of children classified as ADHD (Méndez-Freije, et al., 2023; Parks et al., 2023), and with respect to the psychometric properties of the psychometric instrument used to test sentence comprehension (Parks et al., 2024).

Given the fact that comorbid DLD+ADHD is relatively common, it can be assumed that the separation of children into two distinct groups, namely the isolated ADHD group and the comorbid DLD+ADHD group, had a significant impact on the results obtained. In 2016, Redmond demonstrated that there was a modest positive correlation between the severity of the participants' ADHD symptoms and their sentence recall performance. The finding suggested a tendency for participants with higher levels of ADHD symptoms to perform better than those with lower levels. The accuracy of this claim in the context of sentence comprehension requires further investigation.

Redmond et al. (2024) hoewer note that children exhibiting the most severe symptoms of ADHD are more likely to be at higher risk for diminished language performance in comparison to children experiencing less severe symptoms. In this study, the variances of specific ADHD symptoms (inattention, hyperactivity) were not specified in children with ADHD. This may contribute to variations in the ability to understand sentences, as well as other psycholinguistic abilities.

Sentence comprehension, together with syntactic ability, is a strong predictor of reading comprehension in children (Scott, 2009). Furthermore, reading comprehension is a strong predictor of academic achievement (Keskin, 2013).

In the present study, parents of children diagnosed with ADHD and ADHD+DLD reported elevated levels of challenges in the inhibition domain. Conversely, parents of children with isolated DLD did not report such difficulties. This is not consistent with other research findings conducted by Larson et al. (2020) and Marini et al. (2020). A possible explanation of a different outcome may be gender distribution. In our cohort, gender distribution among children with DLD was balanced and the results showed parents of girls tended to report less difficulty in inhibition. In all studies that have used Brief to test children with DLD (Vugs et al. 2014; Wittke et al., 2013; Cuperus et al. 2014) were enrolled a greater proportion of male subjects than female subjects. This can caused gender bias (Quinn & Madhoo) when girls are often reported to present with fewer issues than boys. Possible explanations have been offered including masking the severity of issues by girls who struggle societal pressure to be ‘a good girl’, etc.

Additional factor could be failure to take into account the presence of comorbidity. For instance, Larson et al. (2020) included only a small number of children and did not investigate possible comorbidity of DLD + ADHD.

In this study, parents of children with ADHD and ADHD + DLD reported working memory and cognitive shifting difficulties, but not parents of children with DLD. Several studies report subnormal results in children with DLD in these areas of EF. The explanation of this phenomenon might be similar to that of the inhibition ability.

The present study did not set out to elucidate the relationship between sentence comprehension and executive functions. Instead, the objective was to draw attention to the fact that parents are more likely to recognise their children's difficulties when these difficulties are clearly expressed in behaviour. Reports from the US and UK indicate that only a small minority of children (< 40%) who would fit a DLD designation in these countries are ever identified or enrolled in clinical services (McGregor, 2020). Underdiagnosis is also a recognised problem in ADHD (Rowland et al., 2015).

It has been demonstrated that children diagnosed with ADHD have been observed to exhibit subclinical language difficulties, while those diagnosed with Developmental Language Disorder (DLD) have been observed to demonstrate subclinical difficulties with executive functions. These subclinical impairments have the potential to influence the necessity for intervention.

If parents are unaware that their child has difficulty understanding sentences or EF, they cannot seek an appropriate intervention method. And this study showed that parents in DLD group were unaware of their children's difficulties with EF. Reports suggest that children with comorbid ADHD+DLD receive spe-

ech-language services at a higher rate than children with DLD (Redmond, 2016). It is imperative to acknowledge that the concomitant occurrence of ADHD and DLD is a prevalent phenomenon within the spectrum of neurodevelopmental conditions. The co-existence of these conditions is frequently associated with the manifestation of heightened symptoms in both conditions for the affected individuals. This observation is indicative of the presence of "additive" or "interactive" effects between the two disorders.

According to (Diamond & Lee) EFs have been demonstrated to be more significant in predicting school readiness than IQ. It is asserted that the predictions concerning reading aptitude persist throughout the entire academic career. Evidently, with a view to enhancing school readiness and academic success, the targeting of EFs is of crucial significance.

These purposes can be achieved from the age of three using the classroom curriculum Tools of the Mind (Tools), which was developed by Bodrova and Leong (2007), or the Montessori programme. Add-ons to the classroom curriculum include PATHS (Promoting Alternative Thinking Strategies) (Kusché & Greenberg, 1994), the CSRP (Chicago School Readiness Project), and additional activities such as Cog-Med© computerised working-memory training, Tae-Kwon-Do, aerobics, yoga training, and mindfulness training sessions.

In conclusion, the limitations of the pilot study must be acknowledged. The size of the research sample must be considered, since the results obtained are not generalisable. The study only employed parental ratings of EF. It is also important to acknowledge the possibility of selection bias, given that the children were not screened for relevant comorbidities (e.g. developmental coordination disorder, anxiety or dyslexia). The severity and variability of ADHD symptoms were not controlled for in the study. Socioeconomic factors that were not analysed may also have influenced the findings of this study.

In future studies, the integration of teacher and parental reports, in conjunction with neuropsychological assessments, should be contemplated. Indeed, teachers report usually significantly more difficulties in EF areas than parents, possibly due to the significantly higher demands of a structured school environment. It is useful to divide children with ADHD into groups according to their symptoms. This approach facilitates the identification of the relationship between sentence comprehension and executive function.

Conclusion

Many professionals suggest that DLD is frequently underdiagnosed. Some children with ADHD may reach a clinical threshold that will qualify them for an additional diagnosis of DLD, but others may not. For this reason, it is advisable to screen children entering school with an isolated diagnosis of DLD for ADHD and children with ADHD for DLD. In both groups, it is essential to determine the level of executive functions, for example, by means of the BRIEF inventory completed by teachers prior to the examination by a psychologist. Furthermore, more comprehensive intervention including executive function training shall be offered in order to improve weakened EFs. It is extremely important to help children with DLD + ADHD to reach a good level of executive functions, as EFs at an early age have been found to predict lifelong achievement, health, wealth and quality of life. Understanding executive functions is key to planning an appropriate intervention.

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