



Oral language in preschool children diagnosed with attention deficit hyperactivity disorder (ADHD)

Linguagem oral em crianças pré-escolares com diagnóstico de transtorno do déficit de atenção e hiperatividade (TDAH)

Lenguaje oral en niños preescolar con diagnóstico de trastorno por déficit de atención con hiperactividad (TDAH)

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Abstract

Introduction: Changes in speech and language development may be present in preschoolers with various neurodevelopmental disorders, possibly indicating a worse prognosis. **Purpose:** This study aimed to assess the developmental level of linguistic aspects in preschoolers diagnosed with attention-deficit/hyperactivity disorder (ADHD). **Methods:** This cross-sectional observational study collected retrospective data from 10 children, aged 4 to 6 years (9 boys), diagnosed with ADHD by a specialized team. Data collection involved a comprehensive examination of the child's history, including pre-, peri-, and post-natal factors, and measures of receptive and expressive language, expressive vocabulary, phonology, and pragmatic aspects. Descriptive statistical analysis was performed. **Results:** Caregivers/guardians reported complaints primarily related to agitated/impulsive behavior and expressive language/speech difficulties. Some children faced challenges in completing more extensive and complex assessment

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JHAS: data collection, analysis and interpretation, article writing;

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instruments due to attention deficits. Expressive language, phonological aspects, and expressive vocabulary were identified as the most affected areas, with changes in respectively 50%, 60%, and 50% of cases. Speech-language-hearing therapy was recommended for 80% of the children. **Conclusion:** The findings highlight the prevalence of speech and language impairments in preschoolers with ADHD, underscoring the importance of early intervention in this high-risk population.

Keywords: Child Language; Cognition; Attention Deficit Disorder with Hyperactivity; Neurodevelopmental Disorders; Child, Preschool.

Resumo

Introdução: Alterações no desenvolvimento da fala e linguagem podem estar presentes em pré-escolares com diversos transtornos do neurodesenvolvimento, sendo que, a presença dessas alterações pode indicar um pior prognóstico. **Objetivo:** Analisar o nível de desenvolvimento dos aspectos linguísticos de crianças pré-escolares com diagnóstico de TDAH. **Métodos:** Estudo observacional transversal de coleta de dados de forma retrospectiva. Participaram 10 crianças com idade entre 4 anos e 6 anos (9 meninos) com diagnóstico de TDAH realizado por equipe especializada. Os dados coletados para este estudo envolveram o histórico da criança (alterações pré, peri e pós-natal), as medidas de linguagem receptiva e expressiva, vocabulário expressivo, fonologia e aspecto pragmático. A análise estatística foi descritiva. **Resultados:** as queixas referidas pelos cuidadores/responsáveis englobaram principalmente o comportamento agitado/impulsivo e a linguagem expressiva/fala; em relação à avaliação linguística, algumas crianças não conseguiram finalizar a aplicação de instrumentos de avaliação que eram mais extensos (exigiam maior de tempo de atenção) e complexos. Em relação aos aspectos avaliados, a linguagem expressiva, o aspecto fonológico e o vocabulário expressivo foram os mais alterados (50%, 60% e 50% de alterações respectivamente). O tratamento fonoaudiológico foi indicado para 80% das crianças. **Conclusão:** alterações de fala e linguagem são prevalentes em pré-escolares com TDAH, sendo este um grupo de alto risco.

Palavras-chave: Linguagem Infantil; Cognição; Transtorno do Déficit de Atenção com Hiperatividade; Transtornos do Neurodesenvolvimento; Pré-escolar.

Resumen

Introducción: Los cambios en el desarrollo del habla y el lenguaje pueden estar presentes en niños preescolares con diversos trastornos del neurodesarrollo, y la presencia de estos cambios puede indicar un peor pronóstico. **Objetivo:** Analizar el nivel de desarrollo de los aspectos lingüísticos en niños en edad preescolar con diagnóstico de TDAH. **Métodos:** Se llevó a cabo un estudio observacional transversal con recolección de datos de manera retrospectiva. Participaron 10 niños con edades entre 4 y 6 años (9 varones) con diagnóstico de TDAH realizado por un equipo especializado. Los datos recolectados para este estudio incluyeron el historial del niño (alteraciones pre, peri y postnatales), medidas de lenguaje receptivo y expresivo, vocabulario expresivo, fonología y aspectos pragmáticos. El análisis estadístico fue descriptivo. **Resultados:** Las quejas reportadas por los cuidadores/responsables abarcaban principalmente el comportamiento agitado/impulsivo y el lenguaje expresivo/habla; con respecto a la evaluación lingüística, algunos niños no pudieron completar la aplicación de instrumentos de evaluación más extensos (que requerían mayor tiempo de atención) y complejos. En cuanto a los aspectos evaluados, el lenguaje expresivo, el aspecto fonológico y el vocabulario expresivo fueron los más alterados (50%, 60% y 50% de alteraciones respectivamente). Se indicó tratamiento fonoaudiológico para el 80% de los niños. **Conclusión:** Las alteraciones del habla y el lenguaje son prevalentes en niños en edad preescolar con TDAH, lo que los convierte en un grupo de alto riesgo.

Palabras clave: Lenguaje Infantil; Cognición; Trastorno por Déficit de Atención con Hiperactividad; Trastornos del Neurodesarrollo; Preescolar.



Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that begins in early childhood, characterized by symptoms of inattention and hyperactivity/impulsivity above those expected for the child's development level and age group¹. The diagnosis of ADHD is essentially clinical – i.e., supported by clear and well-defined clinical operational criteria from classification systems such as the DSM-5-revised¹.

This disorder affects approximately 2% of preschool children (under 6 years old)², in whom symptoms of hyperactivity/impulsivity predominate³. The symptoms of inattention and hyperactivity/impulsivity present in this disorder, according to some authors, result from the impairment of executive functions and attentional skills⁴⁻⁵. Executive functions are a set of mental processes that, in an integrated way, allow the individual to direct behaviors towards goals, evaluate the efficiency and adequacy of these behaviors, abandon ineffective strategies in favor of more efficient ones, and, thus, solve immediate, medium-term, and long-term problems⁶. Various models involve executive functions⁶ – including that of Diamond⁷, which describes three nuclear/basic executive skills relatively independent of each other (cognitive flexibility, working/operational memory, and inhibitory control) and whose combination results in higher executive functions (reasoning, problem-solving, and planning). Another model is the Multicomponent Working Memory proposed by Baddeley and Hitch⁸, according to whom working memory is a short-term memory with limited capacity, involved in the manipulation of information to execute complex cognitive tasks, such as reasoning and understanding.

Some authors conceptualize language as the “reception and expression of ideas and feelings”. In a wider sense, it involves the human ability to communicate through an acquired symbolic code that conveys thoughts, ideas, and emotions⁹. Language can be studied through the receptive sphere (receptive/comprehension language), emissive sphere (expressive language), and its pragmatic, phonological, semantic, and morphosyntactic subcomponents⁹. Adequate language development depends on several variables, such as genetic programming, stimulation/environmental variables, and the adequate development of other cognitive

skills, such as fluid intelligence, attention, working memory, and so forth^{9,10,11,12}.

The combination of ADHD and language impairment is widely explored at school age (above 7 years old) but seldom in preschoolers. Only one of the 22 articles included in the systematic review by Machado-Nascimento et al.¹³ analyzed linguistic changes in children under 6 years old.

Understanding aspects of oral language in preschoolers with ADHD is important to promote early intervention addressing their linguistic changes, as language deficits can interfere with the development of written language, compromising their reading and writing academic performance¹⁴⁻¹⁵. Thus, recognizing this disorder in early childhood and its linguistic comorbidities would lead to appropriate treatment, improving these children's development. This study aimed to analyze the development level of linguistic aspects of preschoolers diagnosed with ADHD.

METHODS

Ethical Considerations

This study was evaluated and approved by the Research Ethics Committee of University of São Paulo Hospital das Clínicas of Ribeirão Preto Medical School, under protocol number 4.020.310 (CAAE 56592722.7.0000.5440). The study collected data from previous reports/examinations and was, therefore, exempted from having participants sign an informed consent form.

Sample selection and characterization

This cross-sectional observational study was carried out retrospectively by analyzing data from medical records.

The sample comprised 10 preschool patients diagnosed with ADHD who, after specialized medical diagnosis, were referred for language/speech assessment. The sample was selected from medical records of patients treated between January 2018 and January 2020 and between June 2022 and June 2023 (interruption in the flow of care due to the COVID-19 pandemic), assessed by a speech-language-hearing (SLH) pathologist specializing in child language. Thus, 45 records were analyzed, of which 10 were included in the sample after inclusion and exclusion criteria. This study did not divide children into groups.



The inclusion criteria were as follows: children assessed by an SLH pathologist specializing in language, monitored at the institution by a specialized multidisciplinary team, aged 4 to 6 years, diagnosed with ADHD.

The exclusion criteria were children with a history of neurological injuries (e.g., stroke, traumatic brain injury, cerebral palsy, and so on), with comorbidities such as autism spectrum disorder, global developmental delay (risk for intellectual disability at school age), childhood apraxia of speech, sensorineural hearing loss, low vision or blindness, difficult-to-control epilepsy and/or severe/moderate anxiety/depression disorder; history of speech therapy to stimulate/rehabilitate linguistic variables. Drug treatment or psychotherapy/parental guidance were not exclusion factors.

Data collection instruments and procedures

After the approval of the Research Ethics Committee, the patients' SLH therapy assessment reports were analyzed. Data regarding diagnosis and medical follow-up, past medical history, and other current follow-ups, such as SLH therapy, occupational therapy follow-up, neuropsychological assessment, and others were also collected from these patients' medical records.

The instruments used in SLH therapy assessment from which data were collected for this study and the variables collected from the child's history are described below.

Many instruments were necessary for a detailed assessment/analysis of each child's linguistic ability. Language assessment specifically requires an evaluation of phonological, semantic, morpho-syntactic, and pragmatic aspects within the receptive sphere (comprehension/discrimination) and emissive sphere, which depend on speech.

- Variables related to the child's history

Data regarding the child's history were collected from their medical records, encompassing gestational data; presence of pre-, peri- and post-natal complications; risk factors and protective factors for development; medical conditions and treatments performed, and so forth. These data aim to include/exclude the child in the sample and characterize the children who were included.

- Language Development Assessment - LDA¹⁶

The tasks on this scale assess the language content and structure. Language content is assessed with tasks focused on the concepts of quantity, quality, spatial and temporal relationships, and sequence. The structure of the language is assessed through tasks relating to morphology and syntax.

The LDA test has Receptive Language and Expressive Language scales. It was applied and scored/analyzed according to the instrument manual guidelines. The test raw score can be transformed into a standard score to classify whether the child has a deficit or adequate language development using the normality table. It is considered adequate when the standard score is above 86, mild deficit when the standard score ranges from 71 to 85, and severe deficit when it is equal to or below 70 (two standard deviations below the expected for the age group).

The classification of the child's performance (normal or abnormal) in the "Global Language Index" and the "Receptive Language" and "Emissive Language" spheres was used for statistical analysis.

- ABFW: Child Language Test – speech domain¹⁷

The Phonological System assessment consists of two tests: imitation and naming. The imitation test has a list of 39 words, and the naming test has 34 figures. The response recorded in both the imitation and naming tests was phonetically transcribed, considering the correct answers, and verifying the child's age and use of phonological processes. The classification of the child's performance (adequate or inadequate) was used for statistical analysis, according to the presence or absence of phonological processes no longer expected for their age, as well as which phonological processes not expected for their age were most prevalent in this age sample.

- Child Naming Test – Emissive vocabulary assessment¹⁸

The Child Naming Test (CNT) assesses expressive vocabulary through picture naming, applicable to children aged 3 to 10 years, by seeing a picture and naming it. There are 60 items to be named by the child and, for each correct answer, they score 1 point. The child's raw score can be transformed into a standard score, considering the child's age group, and classifying their performance as adequate (medium or high performance) or abnormal (low or very low performance).





- Behavioral Observation Protocol¹⁹

This instrument was created in 2004 to systematize the assessment of young children regarding the development of communicative and cognitive skills through behavioral observation. The child is observed for approximately 30 minutes during moments of interaction with their parents and/or evaluator. The protocol is divided into communicative skills (communicative functions, dialogical skills, and means of communication), oral language comprehension, and aspects of cognitive development (level of symbolism and ability to imitate). It was designed to evaluate young children, but it can also be used with older ones with verbalization difficulties, or for other purposes.

This study observed/completed only the area relating to dialogical skills and communicative functions, scoring whether the child had changes in these items. These topics comprise the following items:

- Dialogic skills: Do they initiate conversations/interactions? Do they respond to the interlocutor? Do they wait for their turn (not cutting in or interrupting the interlocutor)? Do they actively participate in the dialog (taking turns in interaction)?
- Communicative functions: instrumental, protest, interactive, naming, informative, heuristic, and narrative aspects.

It should be noted that the observation of behavior to complete this questionnaire occurred throughout the evaluation process – i.e., the child should present such behavior on both days of evaluation/application of standardized tests, and the behavior should appear during both non-directed situations (e.g., a playful situation) and the application of standardized tests.

Data analysis

Descriptive statistics were used to analyze the data (mean, standard deviation, percentage, and so on). Statistical inference was not carried out due to the small sample number, the variability in collected data, and the absence of a control/reference group.

Results

The sample had 10 preschoolers, of whom nine (90%) were males, with a mean age of 5.2 years (standard deviation of 0.7), and eight (80%) were in preschool – one child had started the first year of elementary school, and another one was not attending school, despite medical advice.

Table 1 shows the variables related to the children’s history.

Table 1. Variables related to pre-, peri- and post-natal medical history.

	Variables	No.	%
Prenatal	Drug/alcohol/tobacco use	3	30%
	Maternal physical diseases	1	10%
	Maternal psychological diseases	3	30%
Birth and perinatal	Full-term	7	70%
	Pre-term	2	20%
	Post-term	1	10%
Postnatal	Neuropsychomotor development (adequate)	6	60%
	Speech and language development (adequate)	3	30%
	Recurrent middle-ear infections	2	30%
	Hospitalizations	5	50%
	Other risk factors for development (example: teenage mother)	2	20%

Source: Developed by the authors





As seen in Table 1, 50% of the children had several hospitalizations, due to nephrotic syndrome, constant pneumonia (cause still under investigation), or congenital syphilis. Most children (70%) had a delay in the milestone of uttering their first words (speech/language delay), and 50% also had a delay in neuropsychomotor development.

Behavioral complaints were the most reported by parents/guardians in the SLH assessment (Table 2), followed by complaints of changes

in phonological/emissive language. Regarding behavior, psychomotor agitation was the most prevalent (70%). Other behavior variables included complaints of aggression, animal abuse, tantrums, interaction difficulties, and inappropriate behaviors such as hypersexualization and low tolerance to frustration. Complaints regarding learning, memory, inattention, and receptive language/comprehension were not quite prevalent.

Table 2. Main complaints presented by the children’s parents/guardians during the speech-language-hearing interview

	Complaints	No.	%
Behavior	Psychomotor agitation	7	70%
	Oppositional-defiant	4	40%
	Inattention	1	10%
	Others	7	70%
Language	Comprehension/receptive language	1	10%
	Phonology/emissive language	5	50%
Others	Learning, reading/writing	2	20%
	Memory	1	10%

Source: Developed by the authors

Tables 3 and 4 show the results of the linguistic aspects, classified as adequate or inadequate ac-

ording to what is expected for the age group and the score of each instrument.

Table 3. Performance of preschoolers with ADHD on the different instruments that assessed aspects of oral language

Aspects/instrument	Classification of performance, according to age, in each instrument	No.	%
Receptive language (LDA)	Adequate	7	70
	Inadequate	1	10
	Not performed due to the child’s lack of cooperation	2	20
Expressive language (LDA)	Adequate	3	30
	Inadequate	5	50
	Not performed due to the child’s lack of cooperation	2	20
“Total” language (expressive + receptive - LDA)	Adequate	3	30
	Inadequate	5	50
	Not performed due to the child’s lack of cooperation	2	20
Expressive vocabulary (CNT)	Adequate	6	60
	Inadequate	4	40
	Not performed due to the child’s lack of cooperation	0	0
Phonology (ABFW)	Adequate	4	40
	Inadequate	6	60
	Not performed due to the child’s lack of cooperation	0	0

Source: Developed by the authors

LDA – Language development assessment16; ABFW – Phonology17; CNT – Child Naming test18; PROC – Behavioral Observation Protocol19





Table 4. Number/percentage of preschool children with ADHD with CHANGES in the study aspects

	Study aspects	N (abnormal)	% (abnormal)
Dialogical skills (PROC)	Communicative intention	0	0
	Begins conversation/interaction	0	0
	Responds to the interlocutor	0	0
	Waits for their turn	10	100%
	Keeps the conversation topic	3	30%
Communicative functions (PROC)	Instrumental	0	0
	Protest	1	10%
	Interactive	0	0
	Naming	0	0
	Informative	0	0
	Heuristic	1	10%
	Narrative	5	50%

Source: Developed by the authors
PROC – Behavioral Observation Protocol⁽¹⁹⁾

Table 3 presents data on language assessment and its aspects (development, semantics – emissive vocabulary, and phonology). Those who obtained scores below those expected for the age group in the language development assessment were considered inadequate, characterizing a deficit. Two children (20%) did not finish the LDA test or had unreliable results due to behavior (agitation, little collaboration, and so on).

Phonology was inadequate in 60% of the children – i.e., they used phonological processes no longer expected for their age, as follows: liquid simplification (6; 60% of children – i.e., all preschoolers with phonological disorders used this process abnormally), fricative plosivation (3; 30%), velar fronting (1; 10%), and mute plosives (1; 10%).

After the assessment, eight (80%) children were referred for SLH therapy.

Discussion

This study aimed to analyze the linguistic performance of preschoolers with ADHD. One aspect of this study is the small sample size, with only 10 preschool-aged children. The diagnosis of ADHD in preschoolers is widely discussed and controversial in the literature. Experts in the area state that the diagnosis of ADHD in preschoolers must be carried out with extreme care by health professionals³.

The challenge for diagnosis in this age group arises from the lack of knowledge about tolerable

levels (normal range) of hyperactivity and impulsivity in them³. In this age group, children are beginning to develop the ability to sustain attention and inhibit/control impulses, making it difficult to identify deficits in relation to executive functions²⁰.

According to Connor³, the severity of agitation/impulsivity/inattention symptoms is one of the most important factors in exploring ADHD as a suspected diagnosis. Children who develop an initial pattern of hyperactive/impulsive and/or inattention symptoms that are clearly greater (i.e., more intense than expected for their age or level of development) would be at risk for the development of this disorder. Another indication would be the persistence and duration of symptoms in all the child’s contexts. In this study sample, the caregivers’ complaints at the time of the SLH assessment included significant psychomotor agitation, challenging behavior, and other behavioral complaints such as low frustration tolerance. Moreover, two children (20% of the sample) were unable to complete some tests due to their agitated and/or oppositional behavior.

This study also observed a high prevalence of males (90%) – agreeing with data in the literature, which states that ADHD affects more boys than girls (ratio of 4:1 in clinical studies and 2.4:1 in population studies)²¹. Males have more hyperactive, impulsive behaviors and more notable symptoms, whereas girls predominantly have inattentive behaviors, leading to greater referral of boys^{1,21}, especially at a young age.



Despite the many previous studies, the precise causes of ADHD are not yet completely defined and are believed to be multifactorial. There is good acceptance in the literature about the influence of environmental and genetic factors on the genesis of this disorder. There is a high heritability of ADHD, estimated between 60 and 80% (genetic factors). Risk factors for ADHD include environmental factors acting on the child's emotional development and adaptive functioning (e.g., family disagreements, parental separation, mental disorders in one of the parents, large family, low socioeconomic level, parental criminality, and so forth), exposure to alcohol, tobacco, and drugs during pregnancy, and other pregnancy or childbirth complications (toxemia, eclampsia, prematurity, low birth weight, pre-partum hemorrhage, and so on)²¹. This study found the occurrence of several risk factors mentioned above, such as drug/tobacco use during pregnancy, caregivers with important mental illnesses, premature birth, and so on. The diagnosis of ADHD or other neurodevelopmental disorders in family members was not addressed.

Although language changes are not part of the diagnostic criteria for ADHD, these children's caregivers commonly report that their children have difficulties in language development²². Most complaints analyzed during data collection for this study were expressive language/speech difficulties, besides behavioral complaints. Speech/expressive language changes were the most prevalent after the SLH assessment, agreeing with the complaint presented by caregivers.

The most prevalent combined ADHD and linguistic changes in this study were pragmatic difficulties (difficulty in waiting/respecting communicative turns and difficulties in narrative); phonological changes; and changes in emissive vocabulary and emissive language, consequently affecting the general language level. The receptive language/comprehension skill was little affected. The multicenter study by Posner et al.²³, which likewise evaluated preschoolers with ADHD (sample of 303 preschoolers with moderate to severe ADHD), found that 10% of them had phonological disorders, and 7% had language disorders with expression impairment. The receptive sphere was altered in only 2% of the sample. The percentages found in the study by Posner et al.²⁴, despite being lower than the ones in the present study, agree that phonological changes and changes in emissive

language are the most frequent in preschoolers with ADHD.

The systematic review and meta-analysis by Korrel et al.²⁴ regarding combined ADHD and linguistic changes (as addressed in the present study but encompassing subjects under 18 years old) found that individuals with ADHD had much lower performance than their controls in general language, expressive language, and pragmatic tests. They stated the importance of assessing whether individuals with linguistic changes have ADHD. This meta-analysis²⁴ is the first of its kind, aiming to systematically consolidate the literature on the performance of language skills in children/adolescents with ADHD, according to rigorous diagnoses for language measures.

Concerning pragmatics, children with ADHD have difficulty maintaining the topic of conversation, changing/respecting communicative turns, and narrating (lack of speech coherence and organization)²⁵⁻²⁶. These changes were also found in the preschoolers in this study, all of whom had difficulty respecting/waiting their communicative turn, and half of them had a deficit in narrating facts from their daily lives.

Some researchers argue that pragmatic difficulties are consistent with the theory of executive function deficits (altered baseline skills in people with ADHD), thus providing some support for the theory that executive functions contribute to pragmatic language competence. However, there is little empirical evidence of specific relationships between particular aspects of pragmatic language and specific domains of executive functions²⁵. Other authors also try to relate pragmatic difficulties, especially excessive talking and difficulty in respecting communicative turns, to symptoms of hyperactivity²⁴.

One of the possible explanations why children with ADHD are at greater risk of language disorders is the relationship between language development and executive functions. It is known that the neuropsychological profile of individuals with ADHD is changes in executive functions⁴⁻⁵, and executive functions and language are interrelated skills. An example of this relationship is the importance of working memory (an executive function) for the development of vocabulary, narrative, oral comprehension, and reading/writing^{9-11,27}. Another explanation is that phonology and vocabulary (most affected in preschoolers with ADHD) are the lin-



guistic aspects that most depend on environmental stimulation for their adequate development¹⁰. Since children with ADHD may have a low selective attention capacity (being unable to select the stimuli, addressing different information, impairing the full use of environmental stimuli) and sustained attention difficulties²⁸, these can present deficits in sound processing (auditory processing) and, consequently, phonological changes and low vocabulary.

Lastly, this study found that 80% of the children were referred for SLH therapy because they had a language disorder. In a recent study²⁹ that aimed to analyze attitudes and management carried out by pediatric neurologists in children/adolescents with ADHD, approximately 60% of such professionals reported observing changes in oral and/or written language on several occasions in children with ADHD and referred them to SLH therapy/assessment.

These findings help us understand the importance of SLH assessment of preschoolers with ADHD, detecting and rehabilitating linguistic changes early, and minimizing the possible pedagogical, social, and emotional consequences to the children and their families.

The limitations of this study include the analysis of medical records of preschoolers previously assessed by an SLH pathologist, not specifically focused on ADHD. Another limitation is that these children, due to their behavior and their young age, did not have a neuropsychological assessment measuring executive functions and intellectual estimation, which is generally requested in cases of ADHD in schoolchildren and adults.

Conclusion

Preschoolers with ADHD have a high prevalence of language disorders, characterizing a risk group. The complaints reported by caregivers/guardians encompass their behavior (agitation, impulsivity, and other inappropriate behaviors) and expressive language/speech. Agreeing with those parents'/caregivers' complaints, the most prevalent linguistic changes in this sample involve expressive language, phonology, emissive vocabulary, and specific pragmatic changes (difficulties in exchanging/respecting communicative turns and narrative).

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