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Phonological Simplification Processes in Early Childhood Education Students: Typical Development and Developmental Language Disorder

Procesos de simplificación fonológica en alumnado de Educación Infantil: desarrollo típico y trastorno del desarrollo del lenguaje

Processos de simplificação fonológica em alunos da Educação de Infância: desenvolvimento típico e transtorno do desenvolvimento da linguagem.

幼儿教育阶段学生的语音简化过程：典型的发育轨迹与语言发育障碍的比较

عمليات التبسيط الصوتي لدى طلاب مرحلة التعليم الطفولي: التطور النمطي واضطراب تطور اللغة

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Abstract

Speech development in some children does not proceed as it usually does in typical development (TD), a circumstance that can affect various areas of development and learning. These children produce phonologically simplified words as a result of the application of strategies known as Phonological Simplification Processes (PSF). The application of PSF is not motivated by motor, morphological, sensory, or neurological causes. It usually happens that, over the years, there is a progressive elimination of PSF. However, a group characterized by presenting PSF until an advanced age is those diagnosed with Developmental Language Disorder (DLD). The main objective of this research is to describe and compare the phonological problems of Early Childhood Education students with Developmental Language Disorder (DLD) and typical development (TD). For this purpose, 96 male and female pupils were selected, to meet the diagnostic criteria of the DLD group, the Clinical Evaluation of Language Fundamentals Spanish (CELF-4) language test was administered. Phonological productions were obtained by applying the Induced Phonological Register test.The results conclude that at the levels analyzed there is usually a greater presence of errors in the group with DLD, so they can become more persistent, with consequences that can affect the development of other phonological processing skills (for example, phonological awareness) and of grammar. An educational response is proposed through a Multi-Tiered System of Support (MTSS).

Keywords: Developmental language disorder, early childhood education, speech, phonological simplification processes

Resumen

El desarrollo del habla en algunos niños no discurre como lo hace habitualmente en el desarrollo típico, circunstancia que puede afectar a diversas áreas del desarrollo y del aprendizaje. Estos niños producen palabras fonológicamente simplificadas como resultado de la aplicación de estrategias conocidas como Procesos de Simplificación Fonológica (PSF). La aplicación de PSF no está motivada por causas motoras, morfológicas, sensoriales, o neurológicas. Suele ocurrir que se produzca, con el paso de los años, una eliminación progresiva de los PSF. Sin embargo, un grupo caracterizado por presentar PSF hasta una edad avanzada es el diagnosticado con Trastorno del Desarrollo del Lenguaje (TDL). El objetivo principal de la presente investigación es describir y comparar los problemas fonológicos de alumnado de Educación Infantil con Trastorno del Desarrollo del Lenguaje (TDL) y desarrollo típico (DT). Con esta finalidad, se selecciona a 96 alumnos y alumnas, para cumplir con el criterio diagnóstico del grupo de TDL, se administró la prueba de lenguaje Clinical Evaluation of Language Fundamentals Spanish (CELF-4). Las producciones fonológicas se obtuvieron mediante la aplicación de la prueba del Registro Fonológico Inducido (RFI). Los resultados concluyen que en los niveles analizados suele haber una mayor presencia de errores en el grupo con TDL por lo que pueden volverse más persistentes, con consecuencias que pueden afectar al desarrollo de otras habilidades de procesamiento fonológico (por ejemplo, la conciencia fonológica) y de la gramática. Se propone una respuesta educativa a través de un Sistema de Apoyo de Múltiples Niveles (SAMN).

Palabras clave: Trastorno del desarrollo del lenguaje, educación infantil, habla, procesos simplificación fonológica

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Resumo

O desenvolvimento da fala em algumas crianças não se processa como no desenvolvimento típico, o que pode afetar várias áreas do desenvolvimento e da aprendizagem. Estas crianças produzem palavras fonologicamente simplificadas como resultado da aplicação de estratégias conhecidas como Processos de Simplificação Fonológica (PSF). A aplicação de PSF não é motivada por causas motoras, morfológicas, sensoriais ou neurológicas. É frequente que os PSF sejam progressivamente eliminados ao longo dos anos. No entanto, um grupo que se caracteriza por apresentar PSF até uma idade avançada é o das pessoas diagnosticadas com Perturbação do Desenvolvimento da Linguagem (PDL). O principal objetivo da presente investigação é descrever e comparar os problemas fonológicos de alunos da Educação Pré-Escolar com Perturbação do Desenvolvimento da Linguagem (PDL) e desenvolvimento típico (DT). Com esta finalidade, foram selecionados 96 alunos para cumprir o critério de diagnóstico do grupo de TDL, tendo sido aplicado o teste de linguagem Clinical Evaluation of Language Fundamentals Spanish (CELF-4). As produções fonológicas foram obtidas através da aplicação do teste do Registo Fonológico Induzido (RFI). Os resultados concluem que, nos níveis analisados, tende a haver uma maior presença de erros no grupo com TDL e que estes podem tornar-se mais persistentes, com consequências que podem afetar o desenvolvimento de outras competências de processamento fonológico (por exemplo, a consciência fonológica) e da gramática. É proposta uma resposta educativa através de um Sistema de Apoio de Múltiplos Níveis (SAMN).

Palavras-chave: Perturbação do desenvolvimento da linguagem, educação de infância, fala, processos simplificação fonológica.

摘要

某些儿童的言语发育未能如典型的发育轨迹般顺利进行，这种情况可能影响他们的多项发展和学习能力。这些儿童会由于被施加称为语音简化过程（PSF）的治疗策略，而发出语音简化的词汇。PSF的应用并非由运动、形态、感官或神经因素导致。通常情况下，PSF策略的应用会随着年龄增长逐渐被撤除。然而，一部分儿童会在较高年龄阶段仍需要应用显著的PSF，这些儿童通常被诊断为语言发育障碍（TDL）。

本研究的主要目标是描述并比较患有语言发育障碍（TDL）和具有典型的发育轨迹的幼儿教育阶段学生的语音问题。为此，研究选取了96名学生，其中符合TDL组诊断标准的学生接受了《西班牙语临床语言基础评估量表》（CELF-4）测试。语音样本通过应用**诱导语音记录法（RFI）**获得。

研究结果表明，TDL 组在分析的语音层面中存在更多的错误，这些错误往往更为持续，可能对其他语音处理技能（例如语音意识）以及语法发展造成负面影响。基于此，研究提出了一种通过**多层次支持系统（SAMN）**进行教育干预的建议。

关键词：语言发育障碍、幼儿教育、语言、语音简化过程

ملخص

تطور الكلام لدى بعض الأطفال لا يسير بنفس الطريقة التي يحدث بها في التطور النمطي، وهي حالة قد تؤثر على مجالات مختلفة من التطور والتعلم. يقوم هؤلاء الأطفال بإنتاج كلمات مبسطة صوتيًا نتيجة لاستخدام استراتيجيات تُعرف بـ "عمليات التبسيط الصوتي" (PSF). لا يكون تطبيق PSF مدفوعًا بأسباب حركية أو شكلية أو حسية أو عصبية. عادةً، يحدث بمرور السنوات تقليل تدريجي في استخدام هذه العمليات حتى حتى عمر متقدم، وهي المجموعة التي (PSF) ومع ذلك، هناك مجموعة تتميز باستمرار استخدام عمليات التبسيط الصوتي. يتم التخلص منها الهدف الرئيسي من هذه الدراسة هو وصف ومقارنة المشكلات الصوتية لدى طلاب مرحلة (TDL). يتم تشخيصها باضطراب تطور اللغة لتحقيق هذا الهدف، تم اختيار 96 (DT). مع أقرانهم ذوي التطور النمطي (TDL) التعليم الطفولي الذين يعانون من اضطراب تطور اللغة تم (CELF-4) ، تم تطبيق اختبار اللغة التقييم السريري للأسس اللغوية بالإسبانيةTDL طالبًا وطالبة. لتلبية معايير التشخيص لمجموعة تشير النتائج إلى أن المستويات التي تم تحليلها (RFI). الحصول على الإنتاجات الصوتية من خلال تطبيق اختبار السجل الصوتي المستحث ، مما يجعل هذه الأخطاء أكثر استمرارية. يمكن أن (TDL) تظهر وجودًا أكبر للأخطاء في المجموعة التي تعاني من اضطراب تطور اللغة تكون لهذه الأخطاء عواقب تؤثر على تطوير مهارات أخرى في معالجة الأصوات، مثل الوعي الصوتي، وكذلك على تطور القواعد اللغوية. (SAMN). كاستجابة تعليمية، يُقترح تطبيق نظام دعم متعدد المستويات

الكلمات الدالة: اضطراب تطور اللغة، التعليم الطفولي، الكلام، عمليات التبسيط الصوتي

Introduction

There is an increasing evidence, there is more evidence of the importance of language in children's education. It becomes a crucial tool for sharing daily experiences and classroom activities from an early age. As with other aspects of human development (e.g., crawling or taking first steps), the individual progression of speech sound development is variable, and the order and timing of milestones are not necessarily obligatory (McLeod & Crowe, 2018). Some children may skip milestones, produce others first, revert to earlier ones, or master several simultaneously, but they eventually reach maturity without a negative impact on daily life. There is general agreement that individual differences occur throughout speech and language development (Kit Sum et al., 2022).

However, a considerable number of students do not reach the key developmental milestones that allow them to communicate and learn, impacting their daily routines. In these cases, language acquisition and development delays require a prompt response from the educational system. Specifically, support programs need to be planned, designed, and implemented from a preventive and proactive perspective. One of the most common delays in early childhood education involves speech difficulties. This includes students who experience delays in sound production in the absence of evident motor, structural, sensory, cognitive, or neurological causes (Storkel, 2018). Therefore, this group is highly heterogeneous, with great diversity related to the nature, types of errors produced, and their severity.

Given the nature of this study, it is essential to differentiate between children who have difficulty pronouncing words due to articulation problems (issues coordinating and fluently performing oromotor movements) and those whose problems stem from their limitations in acquiring contrasts between phonemes and understanding the phonotactic rules of the Spanish phonological system. This distinction is crucial for evaluating and intervening in childhood speech difficulties (Broomfield & Dodd, 2011).

It seems evident that the presence of speech difficulties during the early years of schooling can affect various areas of development and learning, such as social communication, friendships, cooperative group work, socio-emotional growth, and reading (McGill et al., 2021; McLeod et al., 2019). The impact is heightened when these difficulties are present during the transition from early childhood education to primary education, a period when formal reading instruction begins (Burgoyne et al., 2019; Tambyraja et al., 2020, 2022; Zambrana & Regina, 2021). Given this scenario, it is easy to conclude that this is a significant problem for teachers, speech and language specialists, and educational psychologists, as they must simultaneously address speech, language, and reading issues. A group characterized precisely by these related difficulties is those diagnosed with Developmental Language Disorder (DLD), which affects around 7% of the child population. It is defined as a severe and persistent disorder in the acquisition and development of oral language, which can affect one or more of its components (phonological, lexical-semantic, morphosyntactic, pragmatic, and discourse-related) without being associated with a biomedical cause (Bishop et al., 2016, 2017). DLD is caused by a series of environmental and biological risk factors, with its first manifestations usually appearing between one and a half and two years of age, marked by the production of fewer than 50 words and the absence of two-word utterances (this period is often labeled as late talking, Auza, 2021; Reilly et al., 2014). Many of these children will develop significant difficulties in speech, language, or communication, which slows their linguistic development or academic performance, issues that are not resolved by age 5, confirming a diagnosis of DLD. However, as Andreu et al. (2021) remind us, when only phonology is affected, it should not be labeled as DLD but as Speech Sound Disorder (SSD). Following Susanibar et al. (2016), SSD is defined as an impairment in the articulatory

production of sounds (phonetics) and in the misuse of the contrastive segments of a language (phonology). SSD is associated with morphological, neuromotor, auditory, and/or cognitive-linguistic disorders.

Various explanatory speech processing and production models have been used to study childhood speech: articulatory, psycholinguistic, and linguistic models. They go from the more structuralist and behaviorist approaches focused on the sequence of phoneme acquisition and their distinctive features, through the cognitive theory more interested in how children treat words as unanalyzed wholes rather than as sequences of segments, to the so-called natural phonology theory. The latter starts from the premise that children hear adult words and reproduce them in simplified form through strategies known as Phonological Simplification Processes (PSPs) (Acosta et al., 1998). This theory was promoted by Stampe (1969), who argued that these phonological simplification processes (PSPs) occur innately and universally in all children, who will gradually suppress them until they produce adult speech. In other words, children with typical development progressively acquire the adult system to which they are exposed by eliminating the PSPs operating in their systems. For example, reducing elements in consonant clusters at the beginning of words is a process that children must learn to eliminate during the acquisition of Spanish. In general, children with typical development naturally suppress PSPs.

In contrast, those diagnosed with DLD need planned and explicit support, which is realized through different intervention programs, particularly those based on metaphonology, minimal pairs, and focused stimulation. All these approaches share a common goal: suppressing error patterns that improve speech intelligibility. Metaphonology is designed to enhance phonological skills by focusing on children's awareness and use of metalinguistic attributes and the contrastive nature of phonemes; in minimal pairs, the adult can provoke a communicative error by responding to what the child says, encouraging self-correction; finally, focused stimulation exposes the child to concentrated input of a specific word in natural communication contexts (Aguado, 2013; Oliveira et al., 2015; Hegarty et al., 2018; Rojas & Susanibar, 2019).

As for the causes behind PSPs, González (1989) lists three main reasons:

- Children have a limited memory capacity, making it impossible to retain the entire adult word.
- Children have a limited representation capacity, and they store a simplified representation of adult words that is closer to their own representations.
- Children possess limited articulatory skills and take a long time to develop the necessary articulatory ability for their pronunciations, as stored in memory, to match those of adults.

Phonological Simplification Processes (PSPs) are typically classified in two ways. Some studies distinguish between those occurring at the word, syllable, or phoneme level (Aguilar & Serra, 2003; Serra et al., 2000), while others propose a classification that differentiates between processes related to syllable and word structure, assimilatory processes, and systemic or substitution processes (Bosch, 2003, 2004; Mejía & Jackson-Maldonado, 2017; Susanibar et al., 2016). Previous studies conducted with schoolchildren from the Canary Islands have identified some of the processes detailed below (Acosta et al., 1998):

- Word Level
  - Omission of syllables within a word: omission of an unstressed syllable (e.g., pelota → óta); omission of the stressed syllable (e.g., amariyo → amáyo).
  - Metathesis: inversion of the typical syllable sequence in a word (e.g., peine → penie).
  - Assimilations: changes in sounds or syllables within the same word (e.g., animales → alimáles).
- Syllable Level
  - Reductions in attacks, nuclei, and codas from multiple to one or two elements

(e.g., jaimito → jamito; grande → gande).
  - Omission of consonant clusters (e.g., flor → or; cosér → cosé; muxér → muér).
  - Epenthesis involves inserting elements within a syllable (e.g., flor → folor).
  - Coalescence, which substitutes two sounds for one (e.g., cláro → táro).
- Segmental Level
  - Simplification of phonemes or their component features (e.g., kása → tsa; brúxa → grúxa; rána → lára; rána → dána).

From an evolutionary perspective, the highest number of PSPs typically appears between the ages of 3 and 4, both in English-speaking children (Dodd et al., 2003) and in Spanish-speaking children (Bosch, 2004). From the age of 4, there is usually a progressive reduction in PSPs, likely favored by a remarkable increase in vocabulary that positively influences the child's phonological system and the gradual disappearance of PSPs (Coloma et al., 2010). This phenomenon usually occurs in typically developing children around five years old but not in those with significant developmental delays in language acquisition, that is, those with DLD.

A frequently posed question is: When can a process be considered natural? Specific processes, such as consonant cluster reduction or the substitution of fricative consonants with stops, are considered natural since they represent strategies that simplify language structure and appear in the entire child population. However, some processes are not phonetically motivated because they do not represent a simplification to reduce the phonetic complexity of articulation. Moreover, these are not PSPs that frequently appear in child development. Examples of unnatural processes include the lateralization of stops (/d/ → /l/), the backing of stops or fricatives (/b/ → /g/), or fricatization (/p/ → /f/).

Based on the previous reflections, a distinction is often made between delayed systems and deviant or distorted systems. The former is characterized by children producing PSPs typical of earlier developmental stages, whereas deviant systems show unusual or rare errors in typical acquisition.

In line with these ideas, it is essential to delve into the most active phonological mechanisms in children with DLD from a preventive and early intervention standpoint. This contribution could provide descriptive evidence, offering a more comprehensive understanding of the specific linguistic profiles related to this neurodevelopmental disorder. Therefore, the main objective of this research is to describe and compare the phonological problems of Early Childhood Education students with Developmental Language Disorder (DLD) and those with typical development (TD).

Method

A descriptive study was designed to detail the characteristics of a population or sample to achieve the primary goal of this research. In this case, it seeks to describe the PSPs of Early Childhood Education students with Developmental Language Disorder and typical development. The starting hypothesis of the study is that Early Childhood students with DLD will exhibit a greater number of PSPs than their peers with TD.

Participants

Contact was made with the Education Counseling of the Canary Islands Government and the Educational and Psychopedagogical Orientation Teams (EOEP) of the island of Tenerife (Canary Islands, Spain) to carry out the study, which provided the procedure for conducting the relevant evaluations through the network of public Early Childhood and Primary Education centers on the island of Tenerife.

The group of children with DLD was selected through a convenience sampling method, as they had to meet the diagnostic criteria for DLD. For this purpose, the Clinical Evaluation of Language Fundamentals Spanish, Fourth Edition (CELF-4, Semel et al., 2006) was administered, a test used to evaluate the language of Spanish-speaking children. This test evaluates general linguistic comprehension

and expression processes through tasks involving sentence structure and formulation, concepts and directions, word structure and types, and sentence recall. It is organized into three main indexes: general language skills, receptive language, and expressive language. The age range for the test is from 5 to 21 years old. The administration time typically falls within the 30–40-minute range, though it may vary depending on the student's age, attention, and motivation. The test is used to check if a student has a language disorder, determine the type of intervention needed, verify if there is a problem with expressive, receptive, or both types of language, identify specific areas of language disorder (semantics, morphology, syntax), recognize underlying clinical causes (e.g., working memory), and offer recommendations for designing an intervention program connected to the curriculum. The average reliability coefficients for the Spanish CELF-4 index scores range from .90 to .96. The test's structure was validated through several confirmatory analyses (by age group) to verify the hierarchical structure of the model, all of which showed adequate goodness of fit.

The procedure involved first requesting referrals from psycho-pedagogical guidance teams for students with language difficulties not explained by cognitive and/or auditory deficits. Then, the CELF-4 (Semel et al., 2006) was administered to select participants who scored below 77.5 (-1.5 SD) in at least one of the three leading indices of the test. From the initial sample, 51 students were excluded for not meeting the DLD diagnostic criteria, and 32 children were excluded for not completing the tests due to repeated absences from school.

The need to assess IQ is based on the requirement to rule out intellectual disability. Non-verbal IQ was assessed using the K-BIT intelligence test (Kaufman & Kaufman, 2000). The normality of non-verbal IQ was verified using the Kolmogorov-Smirnov test ($z = .05$; $df = 128$; $p = .098$).

The participants in the TD group were selected through a discretionary sampling method, aiming to balance the TD group in terms of age and non-verbal IQ with the DLD group. Additionally, these students were classmates of their peers with DLD. The gender difference shown in Table 1 is explained by the higher prevalence of DLD in males compared to females (Andreu et al., 2013; Andreu & Sanz-Torrent, 2023). However, it was impossible to select the TD group with a gender balance that matched the DLD group due to difficulties obtaining the corresponding informed family consent.

The final sample for this study comprised 96 students enrolled in ordinary educational centers on the island of Tenerife. Table 1 shows the descriptive statistics for the two groups: (1) a group of children with DLD and (2) a group of children with typical language development (TD).

Table 1. Characteristics of the sample

Group	n	Gender		Age				Non verbal IQ			
		Male	Female	Min	Max	M	SD	Min	Max	M	SD
DLD	49	36	13	5.2	6.3	5.6	0.3	80	106	96	7
TD	47	16	31	5.3	6.2	5.7	0.3	80	106	98	8

Note: DLD = Developmental Language Disorder group; TD = Typical Development group.

Data Collection Instrument

As Aguado (2013) reminds us, the evaluation tool must be appropriately selected, and applying a battery of tests to all children is not advisable. Therefore, it is essential to clarify the test's purpose; the evaluation instrument is determined based on the stated objective. In the present study, a phonological analysis was chosen to identify the PSPs of the students without resorting to other procedures used for other purposes, such as syllable repetition

(phonetic repertoire with a phonetic, not phonological, value), phoneme perception tests (phonological perception of substituted features), and consistency error tests, as suggested by Cervera & Ygual (2001). In similar studies to ours, such as those conducted by Bertel et al. (2016) and Pavez & Coloma (2017), tasks were used in which the stimuli to elicit PSPs corresponded to words, for example, extracted from the TEPROSIF test (Maggiolo & Pavez, 2000). Specifically, phonological productions were obtained by applying the Induced Phonological Register (RFI; Monfort & Juárez, 2006). This test allows for the study of children's speech from a qualitative perspective, both spontaneous naming of words and their imitation, facilitating group comparisons of children of similar ages. It aims to evaluate PSPs to place phonological development at an evolutionary level and determine which delayed or deviant processes are characteristic of child speech based on the number of phonemes in the presented words that were not produced correctly.

The Induced Phonological Register (RFI) consists of 57 cards corresponding to words that broadly cover the phonological spectrum of Spanish speech. Therefore, the results should be analyzed considering the phonetic characteristics of the children's environment, whether at a family or geographical level. For instance, in the Canary Islands, the sound /ɵ/ corresponding to the phoneme /z/ is not pronounced and is replaced by the sound /s/. Additionally, the words presented in the RFI do not all have the same difficulty, as each has a coefficient of probable difficulty that correlates with progressive exposure to the words and the age of the participants. It is well known that children's phonological system acquisition occurs progressively.

The RFI was administered individually to each of the participants in both groups by one of the evaluators from the Acentejo Research Group. The duration of the test was approximately 10 minutes. The image was shown to the child, followed by the question, "What is shown in the picture?" Once the responses were recorded, each word was transcribed to identify the PSPs. As some authors suggest, only the induced language (image naming) was considered since word repetition is not recommended (Cervera & Ygual, 2001).

After applying the RFI, the samples obtained were analyzed using an adaptation of the simplification processes described in the Analysis of Speech Delay Manual (A-RE-HA) (Aguilar & Serra, 2003). Thus, three levels of study for these processes were considered, which were discussed earlier with examples:

- Word Level: This addresses phonological simplification processes that affect the structure of the word, including changes in the word's structure (omissions and additions of syllables) and changes in phonemic sequencing (metathesis and assimilation).
- Syllable Level: This focuses on phonological simplification processes that affect the structure of the syllable, including omissions, diphthong and consonant cluster reductions, addition, coalescence, and syllable metathesis.
- Segmental Level: This addresses phonological simplification processes that affect the phonemes of Spanish speech. In our study, only phoneme substitutions were analyzed.

Data Analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS.25) to address the research objective. Descriptive analyses of central tendency and dispersion were performed for each variable studied with the Induced Phonological Register (RFI). Additionally, the Kolmogorov-Smirnov (K-S) test was calculated to verify the normality of the distribution, and the non-parametric Mann-Whitney U test was used to analyze the differences between the Developmental Language Disorder (DLD) group and the Typical Development (TD) group. Finally, the effect size was calculated using the probability superiority test (Ps_{est}) through Microsoft Excel to interpret the contrast analysis better.

Ethical Considerations

Since the study was made with children, special care was taken with ethical considerations. For this, families were asked to sign an informed consent form detailing the objectives and characteristics of the study, ensuring compliance with the Organic Law 3/2018 of December 5 on Personal Data Protection and guarantee of digital rights (BOE No. 294 of December 6), as well as guaranteeing confidentiality, voluntary participation, and the absence of risks. Under these conditions, the research was approved by the Ethics and Animal Welfare Committee (CEIBA) of the University of La Laguna, with registration number CEIBA2017-0251.

Results

Before analyzing the data obtained with the RFI test, a preliminary analysis was conducted to determine the type of contrast test (parametric or non-parametric). For this, the Kolmogorov-Smirnov (K-S) test was used, and the results indicated $p < .000$, meaning the data did not follow a normal distribution. Therefore, the non-parametric Mann-Whitney U test was used to assess whether there were significant differences between the DLD and TD groups in the variables measured with the RFI.

In general, phonological processes were observed in the DLD and TD groups. However, as shown in Table 2, there was a higher occurrence of errors in the DLD group across all analyzed levels. The mean number of errors for Word-Level Metathesis in the DLD group (M = 1.16; SD = 1.03) was notably higher than in the TD group (M = 0.49; SD = 0.72). There was also a higher number of errors for Word-Level Assimilation in the DLD group (M = 5.73; SD = 5.53) compared to the TD group (M = 0.74; SD = 1.65). Additionally, significant errors were found in Syllable-Level Omission (DLD: M = 2.55; SD = 3.06; TD: M = 0.34; SD = 1.01), and the highest number of errors was found in Segmental-Level Substitution, with the DLD group scoring significantly higher (M = 10.40; SD = 8.31) compared to the TD group (M = 4.42; SD = 6.61).

Table 2. Descriptive Measures of the RFI Variables

Variables	**Group**	**M**	**SD**	**Minimum**	**Maximum**
Word-Level Omission	DLD	,57	1,00	0	4
	TD	,04	,20	0	1
Word-Level Addition	DLD	,082	,28	0	1
	TD	,06	,25	0	1
Word-Level Metathesis	DLD	1,16	1,03	0	4
	TD	,49	,72	0	2
Word-Level Assimilation	DLD	5,73	5,53	0	20
	TD	,74	1,65	0	8
Syllable-Level Omission	DLD	2,55	3,06	0	11
	TD	,34	1,01	0	5
Syllable-Level Reduction	DLD	,55	,74	0	2
	TD	,19	,40	0	1
Syllable-Level Addition	DLD	,86	1,27	0	6
	TD	,15	,47	0	2
Syllable-Level Epenthesis	DLD	,10	,37	0	2
	DT	,06	,25	0	1
Syllable-Level Coalescence	TDL	,86	1,27	0	6
	DT	,15	,47	0	2
Syllable-Level Metathesis	TDL	,10	,37	0	2
	DT	,06	,25	0	1
Segmental-Level Substitution	TDL	10,40	8,31	0	31
	DT	4,42	6,61	0	24

Note: DLD = Developmental Language Disorder group; TD = Typical Development group.

The contrast analyses revealed statistically significant differences in the average number of errors between the DLD and TD groups in most of the Phonological Simplification Processes (PSPs), as shown in Table 3.

In this sense, the greatest significance was reached in Word-Level Metathesis (U = 696.000; p = .000; Ps_{est} = .30), Word-Level Assimilation (U = 445.000; p = .000; Ps_{est} = .19), Syllable-Level Omission (U = 455.000; p = .000; Ps_{est} = .20), Syllable-Level Addition (U = 746.500; p = .000; Ps_{est} = .32), Syllable-Level Coalescence (U = 746.500; p = .000; Ps_{est} = .32), and Segmental-Level Substitution (U = 568.500; p = .000; Ps_{est} = .25).

On the other hand, the Mann-Whitney U test did not confirm statistically significant differences between the two groups in the variables: Word-Level Addition, Syllable-Level Epenthesis, and Syllable-Level Metathesis.

For all the differences found, the effect size was small, according to the interpretation proposed by Erceg-Hurn and Mirosevich (2008).

Table 3. Contrast Analysis in DLD and TD

Variables	**Group**	**Mean Rank**	**U**	**p**	**Ps_{est}**
Word-Level Omission	TDL	54,88	839,000	,001	0,36
	DT	41,85			
Word-Level Addition	TDL	48,92	1131,000	,739	
	DT	48,06			
Word-Level Metathesis	TDL	57,80	696,000	,000	0,30
	DT	38,81			
Word-Level Assimilation	TDL	62,92	445,000	,000	0,19
	DT	33,47			
Syllable-Level Omission	TDL	62,71	455,000	,000	0,20
	DT	33,68			
Syllable-Level Reduction	TDL	54,23	870,500	,010	0,38
	DT	42,52			
Syllable-Level Addition	TDL	56,77	746,500	,000	0,32
	DT	39,88			
Syllable-Level Epenthesis	TDL	48,95	1129,500	,720	
	DT	48,03			
Syllable-Level Coalescence	TDL	56,77	746,500	,000	0,32
	DT	39,88			
Syllable-Level Metathesis	TDL	48,95	1129,500	,720	
	DT	48,03			
Segmental-Level Substitution	TDL	60,41	568,000	,000	0,25
	DT	36,09			

Note: DLD = Developmental Language Disorder group; TD = Typical Development group

At the word level, there is a greater presence of syllable omissions (e.g., coba for escoba; camelo for caramelo), metathesis (e.g., pasato for zapato; craba for cabra), and especially regressive assimilations (e.g., nuna for luna; tenéfono for teléfono; pampana for campana) and progressive assimilations (e.g., mampiposa for mariposa; tortura for tortuga). This last data point is crucial because it almost doubles the occurrence of this PSP in the DLD group compared to the TD group. This PSP tends to disappear by age 4 in more than 50% of children with typical development.

At the syllable level, there is also a clear predominance of PSPs related to coalescence (e.g., puedo for pueblo; difo for grifo), addition (e.g., jojo for ojo; lárbol for árbol), reduction (e.g., lobo for globo; fesa for fresa; ten for tren), and especially omission (e.g., tabor for tambor; lápi for lápiz; edo for dedo) in the DLD group.

Significant differences again appear at the segmental level (e.g., tolo for toro; chol for sol; cuchada for cuchara), with a higher presence of PSPs in the DLD group.

As can be observed, there is an excellent variety of phonological processes in students with DLD, consistent with some previous studies, such as those by Aguilar et al. (2002), Aguilar & Serra (2006), Serra (2002), and Mejía & Jackson-Maldonado (2017).

Discussion and conclusions

This study aimed to analyze the errors produced in a naming task, considered PSPs, in 5.6-year-old children with DLD and TD to determine the differences between these groups and explore their educational and clinical implications.

The results showed that both groups used PSPs when completing the RFI (Monfort & Juárez, 2006) naming task. The phonological processes used by both groups were quite similar, but the frequency of their use was very different, as expected based on the study's hypothesis.

Studies on Spanish-speaking children suggest that by age 4, most PSPs have been satisfactorily resolved. Their presence at age 5 is typically residual, affecting mainly simplifications of consonant clusters (Bosch, 2003, 2004; Susanibar et al., 2016). Our study shows that at an average age of 5.6 years, the DLD group continues to show a significant number of PSPs. As described in the introduction, some authors point out that these processes are due to perceptual, motor, or other factors (González, 1989; Serra et al., 2000), but there is also a dual explanation for this phenomenon (Mejía & Jackson-Maldonado, 2017).

Firstly, one of the characteristics of DLD is a limited memory capacity, which could result in the partial reproduction of adult word forms. PSPs could be explained by a malfunction in the phonological store of working memory in children with DLD. The errors produced at the syllable level, specifically the reduction of consonant clusters and the omission of syllabic codas, would confirm the hypothesis of a deficit in the processing and retention of information in phonological working memory (Mejía & Jackson-Maldonado, 2017).

Secondly, limited neuromuscular maturation may compromise the coordination of articulatory movements. Correct production of speech sounds requires the satisfactory development of fine, coordinated, and sequenced movements to produce words. These PSPs can lead to persistent disorders with clear consequences for learning to read and write (Zambrana & Regina, 2021).

Families and professionals face the dilemma of observing and waiting during early childhood or referring the child to a specialist. Some children may be able to resolve their speech errors later; however, the reality is often different, as many of them continue to show significant errors throughout schooling, even with delayed intervention. Therefore, delaying access to support services or providing insufficient intervention frequency can lead to poor speech outcomes, with adverse effects on education, socio-emotional development, and children's occupational prospects (McGill et al., 2021; McLeod et al., 2019).

In connection with the above reflection and the present study, considering that the average age of the sample (5.6 years) is the age range at which PSPs have a significant and inevitable impact on school learning, and more specifically on learning written language, explicit, non-incidental intervention is suggested. This intervention

should follow a sequence that mirrors typical developmental progression, starting with assimilations and substitutions that affect stop sounds and syllabic coda omissions (Aguado, 2013; Kit Sum et al., 2022). The goal is gradually improving intelligibility, first in words and later in phrases, conversations, and narratives. Therefore, organizing speech stimulation from the Early Childhood Education stage for all children with DLD and TD is crucial.

Our proposal also builds on models that advocate for equity-based inclusion through a Multi-Tiered System of Support (MTSS), with a tiered practice beginning in the classroom and targeting all students (Acosta & Ramírez, 2024). Gradually, group work with all students is reorganized into smaller groupings of 3 to 5 students, providing more opportunities and facilitating repeated practice. Occasionally, individualized action is required. As Aguado (2013) reminds us, the role of parents is crucial through play and book reading, ensuring that PSPs disappear not only in isolated words but also in sentences and discourse.

From a procedural point of view, an eclectic approach is suggested (Hegarty et al., 2018). First, implementing metaphonological activities that enhance lexical, syllabic, and phonemic awareness (Rojas & Susanibar, 2019) is recommended. Second, minimal pairs are used, where two words are paired with all segments being identical except for one, and the two differing segments involve a distinctive feature. For example, a child who substitutes /m/ with /n/ might say "rama" when shown a picture of a frog (Rana). If we then show the child a picture of a branch (rama) and ask them to name it, they will realize they are using two homonyms to refer to two different concepts, prompting them to revise and achieve a correct production. Finally, focused stimulation can reinforce children's speech productions, as it involves the adult repeating the correct word in its target form with a specific prosodic emphasis (Aguado, 2013). This method reformulates the child's speech errors multiple times, encouraging correction.

From a methodological point of view, our study has some limitations. We observed a higher prevalence of boys than girls in the Developmental Language Disorder (DLD) group; however, due to participant availability issues, we could not select a similar gender ratio in the students with Typical Development (TD), which could be considered a methodological limitation. The differences in sex distribution may have affected the conclusions and the generalization of the findings. As a recommendation for future research, we suggest the need for studies with a more balanced sample in terms of sex to confirm the current findings.

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