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Early intervention in the lexical organization of pupils with developmental language disorders☆

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ABSTRACT

The main objective of the present study has been to verify the effectiveness of an intervention program on the lexical organization of pupils with Typical Development and with developmental language disorder. A total of 99 five-year-old pupils from schools in the Tenerife Island (Canary Islands, Spain) participated. The subtests of expressive vocabulary and of receptive and expressive word classes of the CELF-4 were used. The intervention program consisted of 75 sessions lasting 20 minutes each. The results indicated that pupils diagnosed with developmental language disorder initially performed worse in vocabulary and word classes than those with TD. Also, the pupils with developmental language disorder not only improved their performance by the end of the program, but were found to be the group with the greatest gains from the intervention. There are educational implications for organizing an early intervention of an inclusive nature.

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Intervención temprana en la organización léxica de alumnado con trastorno del desarrollo del lenguaje

Palabras clave:
Educación infantil
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Intervención temprana
Organización léxica
Prevención
Trastorno en el desarrollo del lenguaje

RESUMEN

El objetivo principal de la presente investigación es comprobar la efectividad de un programa de intervención sobre la organización léxica de alumnado con desarrollo típico y con trastorno del desarrollo del lenguaje. Participan un total de 99 alumnos de cinco años de edad de colegios de la Isla de Tenerife (Islas Canarias, España). Se utilizan los subtest de vocabulario expresivo, de clases de palabras receptivo y expresivo del CELF-4. El programa de intervención consta de 75 sesiones de 20 minutos de duración. Los resultados indican que el alumnado diagnosticado con trastorno del desarrollo del lenguaje presenta inicialmente un peor rendimiento en vocabulario y clases de palabras que el diagnosticado con desarrollo típico. Una vez finalizado el programa, el alumnado con trastorno del desarrollo del lenguaje además de mejorar su rendimiento, es el grupo que presenta mayores ganancias. Existen implicaciones educativas para organizar una intervención temprana de naturaleza inclusiva.

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Introduction

Lexical organization is a key objective of child development. Indeed, proper development of the content words (nouns, verbs, adjectives), improve understanding of the semantic features of words, and progress in the function words are among the key elements required for progress in other language components such as syntax or discourse. Besides, the acquisition of such skills is essential for learning and academic success, because they establish the necessary basis for reading comprehension, among other

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things (Cueli, Rodríguez, Álvarez, Areces, & González-Castro, 2017; National Early Literacy Panel, 2008). However, many preschool pupils do not end up acquiring a lexical organization that is both broad and deep. Early identification and intervention are the key in such cases (Kelley, 2017).

Vulnerable pupils include those diagnosed with developmental language disorder (DLD), which leads to major difficulties in language learning and use and, specifically, in the acquisition of appropriate lexical organization (Bishop, Snowling, Thompson, & Greenhalgh, 2016, 2017). The main problems are a considerable delay in the appearance of the first words, the need for greater exposure to new words, and inappropriate organization of the qualitative features of lexical categories. This latter aspect affects semantics and it also has a detrimental effect on lexical production and on comprehension of communicative exchanges (Charest & Skoczylas, 2019; Kan & Windsor, 2010; Sheng & McGregor, 2010). This is hardly anecdotal, given that 23% to 40% of pupils with DLD show lexical difficulties (Messer & Dockrell, 2006). However, as Schwartz (2009) states, a convincing explanation remains to be found for the reasons behind these lexical deficits, leading to the question of whether they are located in general cognitive processes, such as working memory and auditory perception, or in the specific language functions associated with these processes, such as phonological working memory and speech perception.

Since the aforementioned studies allude to English-speaking children, it is worth pointing out that some lexical-semantic characteristics have also been examined with Spanish-speaking children. In particular, studies have highlighted important lexical limitations (Serra & Bosch, 1992), as well as less variety in the use of verb forms (Sanz, 2002) and many difficulties in tasks where they are asked to link a word to a referent with little support, i.e., link new words that they have learnt with familiar or non-familiar referents (Andreu, Aguado, Cardona, & Sanz, 2013). Attention is also drawn to the appearance of greater problems in processing and producing reasoned structures (the semantic role of words), i.e., a tendency to produce simple grammatical structures (with fewer arguments) as well as omitting necessary arguments (Sanz, Andreu, Badia, & Sidera, 2011). Bilingual Spanish-Catalan children with DLD show several problems in omissions in function words (Aguilar, Buil, Pérez, Rigo, & Adrover, 2014) and restricted semantic abilities influence comprehension capacities (Buil, Aguilar, & Rodríguez, 2015).

The literature tends to distinguish between the qualitative and quantitative deficits that are often present in pupils with DLD (Motsch & Ulrich, 2012). In the case of a quantitative deficit, the subject has a limited vocabulary largely dominated by high-frequency words. In the case of a qualitative deficit, the vocabulary is much broader but it cannot be activated in everyday communication. Here, the problem is at the level of lexical semantics, as the meaning of the words are not well organized and so, the words are used and understood wrongly. There is probably incomplete storage of the words' semantic features or morphological structure and insufficient connections between different entries to reflect semantic fields and relationships, leading to problems in understanding words and accessing lexicon and evocation errors (Best, 2004; McGregor, Newman, Reilly, & Capone, 2002; Messer & Dockrell, 2006; Sheng & McGregor, 2010).

Given the above, it would appear necessary to design and implement intervention programs aimed at stimulating, as early as possible, lexical organization in pupils with DLD. A triple question has hovered over the debate on how such interventions should be organized. One discussion points whether the model to follow should be semantic or phonological. In other words, the question is whether priority should be given to new words' semantic information by focusing on their features, meanings, associations, definitions, etc., or whether the emphasis should be on manipulating the syllables and sounds that make up the words (phonological awareness). Some results suggest that phonological awareness intervention is important to improve semantic skills (Zens, Gillon, & Moran, 2009). But the greatest evidence comes from the combination of vocabulary techniques promoting deep knowledge of words (definition, lexical depth, demonstration, contextualization, use/grammar) and the phonology for recognizing words identifying their sounds (Justice, Schmitt, Murphy, Pratt, & Biancone, 2014). The second discussion addresses whether teaching methods should be organized explicitly or incidentally. Explicit intervention (Beck, McKeown, & Kucan, 2013) aims to manipulate the conditions of exposure of new words so that children have many opportunities to experience them with various repetitions and in highly informative conditions, for example, simple definitions and numerous examples of how children can use them. While in incidental intervention, children can learn the meaning of unknown words through incidental exposure, for example, during shared storybook reading activities (Coyne, McCoach, & Kapp, 2007). Here, the literature indicates that when preschool children are the subject of an explicit intervention, greater gains or greater effect sizes are observed (Marulis & Neuman, 2010; Nash & Donaldson, 2005). Finally, as an alternative to one-to-one intervention (Baker et al., 2015; Wright, Pring, & Ebbels, 2018) a response to intervention (RTI) has been used. So when teachers apply effective instructional practices, the majority of pupils will make the most of it, whereas some other pupils require additional tiers of support. There are three tiers of support. The tier 1(T1) or support for all pupils; the tier 2 (T2) small group support; and tier 3 (T3) or individualized support. Some studies have dealt with whether the RTI approach can improve the vocabulary of pupils with language difficulties in preschool (Greenwood et al., 2019; Kelley, Goldstein, Spencer, & Sherman, 2015; Loftus, Coyne, McCoach, & Zipoli, 2010; Pullen, Tuckwiller, Konold, Maynard, & Coyne, 2010).

As it was mentioned above, it would appear necessary to design and implement intervention programs aimed at stimulating, as early as possible, lexical organization in pupils with DLD. A twofold question has hovered over the debate on how such interventions should be organized. One discussion centers around whether the model to follow should be semantic or phonological. In other words, the question is whether priority should be given to new words' semantic information by focusing on their features, meanings, associations, definitions, etc., or whether the emphasis should be on manipulating the syllables and sounds that make up the words (phonological awareness). The second discussion addresses whether teaching methods should be organized explicitly or incidentally. Here, the literature indicates that when pupils are the subject of an explicit intervention, greater gains or greater effect sizes are seen (Marulis & Neuman, 2010). It would thus appear that teaching should be both explicit and interactive. It is indeed important to give pupils with DLD many opportunities to respond, offer them interactive modeling, and make frequent use of open questions (Beck et al., 2013; Kelley et al., 2015).

For the present study, an intervention program has been designed that aims to improve lexical organization in pupils with DLD in their final year of preschool. It is based on a hybrid model (Munro, Lee, & Baker, 2008) that gives greater emphasis on semantic activities (word label, meanings) but it does not ignore phonological activities (awareness of the phonological form), and it uses explicit, interactive teaching methods. Having in mind the explanations provided above, two aims have been defined for the present study: first, to establish that a group of pupils diagnosed with DLD present deficits in vocabulary and word classes when compared with a group with typical language development; and second, to demonstrate the effectiveness of an intervention pro-

gram in improving vocabulary and word classes. Specifically, the following hypotheses have been defined:

Hypothesis 1. pupils diagnosed with DLD will perform worse in vocabulary and word classes than pupils with typical language development.

Hypothesis 2. pupils diagnosed with DLD will improve their performance in vocabulary and word classes after participating in an intervention program.

Hypothesis 3. pupils diagnosed with DLD will present greater gains in vocabulary and word classes after participating in an intervention program than a control group of pupils with typical language development and a control group of pupils diagnosed with DLD.

Method

Design

The study applied a pretest-instruction-posttest design to an experimental group of children with developmental language disorder. To complete the design, a non-equivalent experimental group (consisting of pupils with typical development) and two control groups (one equivalent and one not equivalent) were included in the study. Our independent variables were the group and the evaluation time. The dependent variables were three CELF-4 lexical subtests (Semel, Wiig, & Secord, 2006): *expressive vocabulary*, *receptive word classes*, and *expressive word classes*. After the subjects and control variables were identified, the pretest evaluation was administered. Then the intervention program was implemented. Finally, we carried out the posttest evaluation. Both evaluations and intervention were performed in the children's schools. Prior authorization was requested from educational centers and families. Compliance with ethical standards was also positively assessed by the Institutional Review Board.

Participants

In this study, 99 children participated, all of whom were enrolled in schools in the island of Tenerife (Canary Islands, Spain). They were divided into four groups: (1) a treatment group for children with language development disorders (Treatment-DLD = TD); (2) an untreated group of children with language development disorders (Non-Treatment-DLD = ND); (3) a treatment group of children with typical language development (Treatment-Control = TC) and (4) an untreated group of children with typical language development (Non-Treatment-Control = CN). Table 1 shows the descriptive statistics of each group in the Age and non-verbal IQ variables. Both were used to equalize the groups.

Normality of age was checked by the Kolmogorov-Smirnov test ($z = .08$, $df = 99$, $p = .174$). To verify that the groups were matched on this variable, a hypothesis contrast test was performed. As a preliminary step, the homogeneity of variances was determined using Levene's test $F(3, 95) = .6$, $p = .591$. ANOVA showed no significant difference $F(3, 95) = 3.0$, $p = .520$; $\eta^2 = .01$. The K-BIT intelligence test was used to evaluate non-verbal IQ (Kaufman & Kaufman, 2000). Normality of non-verbal IQ was checked by the Kolmogorov-Smirnov test ($z = .10$, $df = 99$, $p = .098$). To verify that the groups were matched on this variable, a hypothesis contrast test was performed. As a preliminary step, the homogeneity of variances was determined using Levene's test $F(3, 95) = 1.9$, $p = .139$. ANOVA showed no significant difference $F(3, 95) = 5.1$, $p = .097$, $\eta^2 = .04$.

Two of the groups were selected by convenience sampling (CD and ED), given that the students were required to meet specific selection criteria. To select the pupils of the DLD groups, an initial screening was carried out in all the schools of the island of Tenerife, in collaboration with school administrators and educational and psychopedagogical guidance counselors. These counselors were asked to refer all students showing possible signs of DLD—that is, problems with comprehension or expression in one or more components of language, but especially in morphosyntax and semantics—or students with several years' history of unresolved language difficulties (Ramírez et al., 2018). A total of 147 pupils were referred in this way, all of whom were put through an exhaustive comprehensive language assessment protocol to confirm the diagnosis, consisting of two standardized tests, the CELF-4 (Semel et al., 2006) and the Registro Fonológico Inducido (Monfort & Juárez, 1989). This administration of the evaluation protocol led to the selection of a sample of 50 students with a diagnosis of DLD, who were randomly assigned to one of the two equivalent groups of the study, attending only to gender. A total of 65 pupils were excluded from the study for presenting simple language delay, that is, a slight chronological lag in development characterized more by phonological than by structural difficulties, and 32 children were excluded for not completing the tests, due to repeated absences or lack of collaboration.

The pupils of the groups with typical development were selected by means of discretionary sampling to ensure the four groups were as similar as possible in other variables that could influence the results. A total of 50 students with typical development were selected from among the classmates of the children with DLD. The pupils in this group did not have any language difficulties and were being schooled within the usual parameters. One pupil was excluded for not completing the tests, due to repeated absences. The final sample therefore consisted of 99 students from different social backgrounds, from both public and private schools as well as rural and urban areas.

Instrument

The main tool used was CELF-4 standardized test (Semel et al., 2006). This is a language assessment test with scales for Spanish speakers in the United States. It evaluates the processes of language comprehension and expression in general, by means of tasks involving the structuring and formulation of sentences, concepts and directions, structure and kinds of words, and remembering sentences.

The subtests for expressive vocabulary, receptive word classes, and expressive word classes were selected. For the expressive vocabulary subtest, a series of flash cards were presented with images showing objects to be named (e.g., What is this? A shoe) or actions to be described (e.g., What is she doing? Cutting). The categories covered by the expressive vocabulary subtest were: verbs, animals/insects, occupations, part/whole, sports, music, science, mathematics, geography/social studies, medical and communication. For the word class subtests, participants were asked to indicate the words that did not belong and were also asked questions like "Why do the words _____ and _____ go together?" The items fell under the following categories: school concepts, sports/recreation, home, clothing, transportation, community, materials, time/quantity and verbs.

The psychometric properties of the three subtests selected with are adequate, both for global Cronbach's alpha internal consistency ($\alpha = .895$) and for each of the subtests (*expressive word classes*: $\alpha = .825$; *receptive word classes*: $\alpha = .799$; *expressive vocabulary*: $\alpha = .879$). Since this parameter is biased by the number of items taken for its calculation, the compound reliability (ω de McDonald) and average variance extracted (AVE) are also calculated, obtaining excellent overall reliability ($\omega = .934$ and AVE = .703) and good reliability by subtests (*expressive word classes:* $\omega = .864$ and AVE = .761;

Table 1
Descriptive statistics of the groups in age and non-verbal IQ.

Study Groups	*n*	Gender		Age				Non-verbal IQ			
		Male	Female	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*
ND	24	14	11	5.2	6.3	5.6	.3	80	106	96	7
NC	25	14	11	5.2	6.3	5.7	.3	89	113	111	6
TD	25	15	10	5.3	6.2	5.7	.3	80	106	98	8
TC	25	15	9	5.2	6.3	5.8	.3	80	120	107	8

Note. ND = Non-Treatment-DLD ($n = 24$). NC = Non-Treatment-Control ($n = 25$). TD = Treatment-DLD ($n = 25$). TC = Treatment-Control ($n = 25$).

receptive word classes: ω = .769 and AVE = .625; *expressive vocabulary*: ω = .849 and AVE = .738).

The other tool, Registro Fonológico Inducido (Monfort & Juárez, 1989), was used exclusively as a complementary measure to check for the presence of speech problems. As speech was not an intervention aim, its pre-post analysis was not considered.

Procedure

The intervention program was implemented by 45 preschool teachers and 30 speech language therapists (SLT), who were provided with 20 h of prior training. They were given a detailed folder with all the necessary materials and were also trained in practical workshop sessions. Throughout the intervention, they received weekly visits from members of our research team during which possible concerns were addressed and explicit classroom support was provided. There were four additional group meetings held over the course of the intervention to ensure that it was running as planned.

A total of 75 daily intervention sessions were developed. Every session lasted 20 minutes and the same structure and materials were used. Every week from Monday to Thursday, the teacher would work with the pupils in the regular classroom context, combining situations involving all pupils (Tier 1) with work in small groups (Tier 2). Therefore, 60 of the sessions were covered with these two tiers. On Fridays, the pupils with DLD would go with two classmates to the speech therapy room to work with the SLT (Tier 3) making 15 of the sessions at this tier. RTI has been used in many vocabulary intervention programs. It has been used in this study for a double reason. Firstly, it allows an organization closer to collaborative (Steele & Mills, 2011) and inclusive practices (Green, Chance, & Stockholm, 2019). Secondly, there is previous research that it indicates its effectiveness in improving vocabulary learning in preschool children (Kelley et al., 2015).

As it is previously stated, the intervention agents were taught to lead the pupil directly to the intervention goals during training. Children carry out actions with the language (name, describe, etc.) in the different activities, using materials as supports (cards, images, objects, etc.). Whereas the techniques make up the active ingredients or procedures to teach or enhance new learning and they include acts such as the following ones (Justice et al., 2014):

- Emphatic stress on new words: focusing the child's attention on the word. "*Quiero una freeeesssssaaaaaaaaa*" *or* "*Quiero una fresa*" *("I want a straaaaabeeeeeeerryyyyyyy" or "I want a straw-berry")*
- Phonological awareness: *ma-ri-po-sa; s-o-l; (*ca*)-fe. (But-ter-fly;s-u-n; (co)-ffee)*
- Use of visual material such as drawings for new, low-frequency words.
- Phonological neighbors: finding words that are phonologically similar.
- Use of gestures to accompany word production.
- Use of simple definitions with the pupil's participation. For example, nutritious: food that is good for you.
- Contextual expansion of words: production of words in complex linguistic contexts (sentences, paragraphs, etc.).
- Bootstrapping, or the provision of phonetic and semantic clues. "*La comen los conejos*...", "*La zana*...". "*Rabbits eat them*....", "*Ca*..."
- Visual organizers: semantic maps, diagrams, etc.
- Open questions.

In the regular classroom, the morning session started with all pupils playing around the game of "Lexicon Pirate" (Motsch & Ulrich, 2012), which is an intensive therapy designed to foster the learning of new words that converts pupils into "lexical vacuum cleaners" (Pinker, 1994). The game simulated a treasure hunt. One child, together with the *Lexicon Pirate* hand puppet, would begin to unearth new or unfamiliar words. In the first phase, the *Pirate's Treasure Chest* was discovered, containing four objects (nouns) and two photographs (verbs). The puppet would help the child to name the words and suggest the pupil with DLD to say them out loud three times, syllable by syllable, extending the vowels (repetition and phonological segmentation). Each session had a different theme, e.g., fruit, clothing, animals, vehicles, tools, cooking, etc. Later, another puppet, the *Wizard*, appeared, who would convert the objects into images so that they could be named and later affixed to the *Treasure Journal*, which was organized by category. Finally, the lexical strategies were transferred to the family context (Gutiérrez-Fresneda, 2019). The pupil with DLD was to bring a new word from home and explain it to the class. This game is designed according to the social-pragmatic approach posited by Tomasello (2003), which highlights interaction, intentional communication, shared attention, and imitation as the basic building blocks for learning words. One aim is to modify how pupils respond when they find themselves in situations where they lack lexical knowledge or when they cannot find the right words.

Once this first activity had been completed, the pupils were divided into small groups of three to five children each. The aim of the next activity was to work in more depth on learning low-frequency words, lexical semantics, lexical access and evocation, and the functional lexicon. The activity formats are listed in Table 2.

Data analysis

In the first place, an ANOVA for each dependent variable studied (subtests of CELF-4) was carried out with the pretest scores, which enabled us to test the initial differences between the groups and thus establish the baseline. In the second place, an ANCOVA for each dependent variable was carried out with the posttest scores to determine if the intervention program produced a performance improvement in the experimental groups over the control groups. The pretest score was used as covariable. Finally, a Mixed ANOVA was carried out with the pretest-posttest difference for each dependent variable studied to determine if there were differential gains after the intervention. As a preliminary step to all ANOVAs performed, the homogeneity of the variances was determined using Levene's test. A η^2 was used as an indicator of effect size for the main effects of ANOVAs. A η^2 around .01 is generally considered

Table 2
Lexico-semantic activity formats

Activity	Description
Lexical naming	Naming objects, actions and attributes using cards
Categorization	Identifying what a group of words has in common and which is the odd one out
Classification	Grouping objects together
Semantic families	Creating semantic families from a single word
Semantic maps	Generating word wheels
Semantic relationships: associated terms	Using cards with two images and building a meaningful sentence from them
Analysis	Listing a set number of elements on the basis of a single concept
Synthesis	Integrating the parts of a limited set to form a whole
Similarities	Finding words that resemble each other (objects, animals, people)
Grammatical association	Finding word associations, for example, three things that a dog can do
Antonyms and synonyms	Relating each word with its opposite, then identifying the words that share characteristics
Definitions	Producing simple definitions, offering examples and counter-examples
Evocation and lexical access	Playing word evocation games where speed (verbal fluency) is rewarded. These can involve naming objects or finding the names of animals, foods, etc.
Functional lexicon	Describing images to work on semantic notions of causality, temporality, purpose, etc.

to be of little effect, a square eta around .06 indicates a medium effect, and a square eta greater than .14 is already a large effect. In the contrasts that presented heterogeneity of variances, the robust Welch's test was used. Orthogonal contrasts were performed as post hoc comparisons in those evaluations that showed significant differences, to identify which groups showed differences. Cohen's *d* was used as an indicator of the effect size for the orthogonal contrasts of the ANOVAs. An effect size up to .3 would be considered small; up to .7 would be considered a medium effect size; and .8 or greater can be considered a large effect size. All analyses were carried out with the program SPSS v25.

Results

Firstly, Table 3 shows the descriptive statistics for the four groups for the pretest and posttest results of each lexical subtest of CELF-4 (Semel et al., 2006), as well as the gains obtained after the intervention program.

Table 4 shows an ANOVA for the pretest results, an ANCOVA for the posttest results of each lexical subtest and an ANOVA on gains for each lexical subtest. As can be seen in all subtests, the results showed significant differences, with a large effect size, both before and after treatment and with the gains obtained.

As it can be seen, before treatment the two groups of children with DLD (Treatment-DLD and Non-Treatment-DLD) showed significantly lower results than the two groups of children with TD (Treatment-Control and Non-Treatment-Control), with a large effect size, while the two groups of children with DLD showed no differences between them. Therefore, the first hypothesis of our research was demonstrated.

On the other hand, after treatment in the *expressive vocabulary subtest*, the Treatment-DLD group showed better performance than the Non-Treatment-DLD group and similar performance to the two groups with TD Treatment-Control and Non-Treatment-Control), at the end of the intervention program. In addition, both in the *expressive word class subtest* and in the *receptive word class subtest*, the Treatment-DLD group showed better performance than both control groups (Non-Treatment-DLD and Non-Treatment-Control) and the Treatment-Control group. Thus, the second hypothesis of our research was demonstrated.

By last, on gains for each lexical subtest, Treatment-DLD group showed greater gains after receiving the intervention program than the other three groups all subtests. Consequently, the last hypothesis of our research was demonstrated.

Discussion

There is broad agreement on the considerable delay suffered by pupils with DLD in learning words, which in turn leads to a lack of awareness of their lexical tags and meanings. This is worsened by the fact that they also show difficulties with lexical semantics, leading to limited expression and comprehension of their interlocutor's message (Leonard, 2014). Specifically, their lexicon is characterized by restrictions in certain word classes, such as nouns and, to a higher degree, verbs and adjectives (Andreu et al., 2012; Sanz, 2002). They typically refer to referents as "that" or "thing", and use high-frequency words such as "dad", "mom", "water", and "ball", with little presence of low-frequency vocabulary. This latter form of vocabulary is key for reading comprehension (Aguilar, Buil, López, Sánchez, & Adrover, 2019) and for accessing curriculum content and permitting academic progress (Dickinson & Porche, 2011).

The above considerations are linked to this study's first hypothesis. The present research showed that pupils with DLD show worse performance in vocabulary and word classes than pupils with typical language development. Many studies have shown that pupils with DLD have a smaller vocabulary than their peers, greater difficulty learning new words, and less capacity to access the lexicon (Alt & Plante, 2006; Andreu et al., 2013; Coady, 2013). They also perform worse at understanding the relationships between words based on the semantic field. From all this, it can be deduced that pupils with DLD are at a clear academic disadvantage both in terms of their expressive vocabulary and in other aspects of lexical semantics. For example, problems in lexical organization have turned out to be the cause of many limitations in reading comprehension skills (Aguilar et al., 2019; Buil et al., 2015).

As Mendoza (2016) reminds us, one of the most telling difficulties of pupils with DLD is their lexical organization, with the

Table 3
Descriptives for measures and Gains after treatment (post–pre) in each lexical subtest

	ND			NC			TD			TC		
	Pre *M* (*SD*)	Post *M* (*SD*)	Gain *M* (*SD*)	Pre *M* (*SD*)	Post *M* (*SD*)	Gain *M* (*SD*)	Pre *M* (*SD*)	Post *M* (*SD*)	Gain *M* (*SD*)	Pre *M* (*SD*)	Post *M* (*SD*)	Gain *M* (*SD*)
EV	17.2 (8.1)	26.9 (7.9)	9.8 (5.5)	44.5 (5.6)	45.3 (6.9)	.8 (6.0)	17.8 (9.0)	30.4 (9.1)	12.7 (7.2)	38.8 (8.0)	46.3 (4.8)	6.2 (7.0)
EWC	8.3 (5.7)	12.6 (5.8)	2.5 (6.9)	22.6 (2.9)	23.3 (2.0)	.8 (3.1)	8.6 (4.2)	16.4 (3.4)	7.8 (4.3)	21.3 (2.1)	23.9 (.9)	2.4 (1.8)
RWC	14.6 (4.4)	17.5 (5.3)	2.8 (4.8)	23.0 (2.7)	23.9 (1.5)	.9 (2.9)	15.9 (4.7)	19.9 (2.6)	4.0 (5.0)	22.8 (1.4)	24.5 (.7)	1.6 (1.3)

Note. ND = Non-Treatment-DLD ($n = 24$). NC = Non-Treatment-Control ($n = 25$). TD = Treatment-DLD ($n = 25$). TC = Treatment-Control ($n = 25$). EV = Expressive vocabulary. EWC = Expressive word class. RWC = Receptive word class.

Table 4
Main effects and orthogonal contrasts for pre, post and gains in each lexical subtest

	$F(3, 95)$	η^2	ND vs NC		ND vs TD		ND vs TC		NC vs TD		NC vs TC		TD vs TC	
			$F(1;97)$	d	$F(1;97)$	d	$F(1;97)$	d	$F(1;97)$	d	$F(1;97)$	d	$F(1;97)$	d
ANOVA pre-test														
EV	83.4***	.73	158.3***	2.0	.2	0.1	98.1***	22.5	147.1***	26.8	6.5*	5.2	89.4***	21.5
EWC	[a] 97.8***	.94	150.6***	1.3	.0	0.2	122.5***	13.0	156.2***	13.9	1.2	0.1	127.2***	12.8
RWC	[a] 37.8***	.55	67.6***	1.1	1.6	0.1	63.0***	8.4	49.4***	7.1	0.0	0.1	45.5***	1.0
ANCOVA post-test														
EV	4.3**	.12	.4	0.8	3.3*	3.9	6.7*	19.0	.3	0.1	6.8*	0.2	1.9	0.3
EWC	[a] 11.2***	27	19.54***	1.3	15.7***	1.4	27.9***	12.0	3.8*	6.9	.9	0.5	7.2**	7.4
RWC	[a] 6.2**	.17	12.7***	1.1	3.4*	3.0	18.0***	1.1	5.7*	4.0	.8	0.5	6.6*	4.5
ANOVA gains after treatment (post–pre)														
EV	[a] 15.8***	.33	2.6	0.2	26.5***	2.8	13.0***	3.6	42.6***	11.9	12.9***	5.4	8.2**	6.4
EWC	[a] 11.3***	.26	5.9*	3.0	9.7**	3.9	.9	0.1	31.4***	7.0	2.1	.2	16.8***	5.4
RWC	3.1*	.09	3.4	0.1	4.3*	1.4	1.1	0.1	3.1*	3.1	.6	.1	4.1*	2.4

Note. ND = Non-Treatment-DLD ($n = 24$). NC = Non-Treatment-Control ($n = 25$). TD = Treatment-DLD ($n = 25$). TC = Treatment-Control ($n = 25$). EV = Expressive vocabulary. EWC = Expressive word class. RWC = Receptive word class.

[a] Welch's *F*.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

priority being to implement programs for optimizing it. However, paradoxically, there has been little research examining the effectiveness of intervention programs and techniques. For this reason, it has seemed appropriate to design an early intervention program for five-year-old pupils. Its application confirms our second hypothesis, since pupils with DLD were seen to improve their performance in vocabulary and in word classes. This implies a dual gain: on the one hand, in the breadth of vocabulary, which will facilitate more fluid and precise communication; on the other hand, in lexical depth, which improves understanding and greater knowledge of categorical relationships. Identifying associations between words allows their meanings to be extended in oral and written discourse, and it constitutes one of the skills evaluated in the curricula of the final year of preschool education.

Furthermore, according to results of previous research (Greenwood et al., 2019), the fact that the intervention was organized along three different tiers of practice, as it is done in multi-tiered instruction, a key component of response to intervention (RTI) models, may explain why the program was effective, and it confirms the third hypothesis: that pupils with DLD show greater gains in vocabulary and word association after receiving an intervention program than a control group of pupils with typical language development and also, than a control group of pupils diagnosed with DLD. In Tier 1, all pupils received high-quality teaching in a large group through the game Lexicon Pirate; immediately afterwards, in Tier 2, a more systematic and explicit teaching approach was used with pupils in small groups. Finally, once a week, Tier 3 was activated, in which teaching was more intensive and held outside the usual classroom, with the participation of an SLT. The literature has shown that interventions based exclusively on large-group teaching do not improve vocabulary in pupils with DLD, and that at least a combination of large-group and small-group teaching is needed (Loftus et al., 2010; Pullen et al., 2010). It is likely that in Tier 1 the pupils with DLD are exposed to a large number of words but, in Tier 2 and Tier 3 the teaching is more explicit, and so they learn more words in greater depth (Coyne et al., 2007; Marulis & Neuman, 2010).

In addition to the three levels of intervention, the implementation of the lexical organization program is characterized by stimulating frequent and interactive practice. The fact that sessions are held daily guarantees greater exposure to the situational vocabulary that favors learning (Beck & McKeown, 2007; Coyne et al., 2007). Interactive practice has also proven to be more effective, as it includes more opportunities for pupils with DLD and it increases the support dose through the use of intervention techniques, already mentioned above, such as simple definitions, phonetic and semantic bootstrapping, visual organizers, and open questions, among others (Beck et al., 2013; Kelley, 2017).

This way of organizing an intervention could fit perfectly within inclusive models, with inclusive education considered a multifaceted practice. One key issue is the empowerment of the figure of the teacher in the implementation of the intervention program, with the collaboration of the SLT. This represents an innovation in how the interaction between teachers and SLTs is understood and, above all, in how it moves away from the traditional delivery model of individualized therapy services. All of the above does not require the abandonment of intervention objectives for the lexical organization of pupils with DLD, but rather a reconceptualization of how we can achieve these objectives by means of a more inclusive and curricular intervention.

Consequently, the educational implications of this research encourage the professional development of teachers, support services such as SLTs and psychopedagogical guidance counselors. It would be pertinent that the offered practices were used more frequently and longer during the school day to strengthen the lexical organization. Moreover, our model could be also applied to other components of oral language and early reading.

This research has some limitations such as the number of participants in the DLD group as well as the lack of audition tests. Furthermore, the evaluation of the program was carried out immediately after the intervention. Follow-up tests should be performed several months after the intervention to determine if the initial benefits observed for the experimental group still remain. The results should be also related to the possible improvement in other components of language such as morphology, phonology and particularly, the early learning of reading. Finally, future research should use two experimental groups of DLD: one would receive phonological techniques and the other one semantic techniques. Probably, more evidence on lexical intervention in children with DLD would be shown.

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