Review articles

Grammar intervention in children with specific language impairment: an integrative literature review

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ABSTRACT

Aim: to review the literature reporting grammar-based interventions designed to improve morphosyntactic skills among children with specific language impairment (SLI).

Methods: several studies reporting grammar-based interventions were analyzed. The criteria for selecting the articles were determined as follows: a) publication date within the last ten years; b) studies that reported a grammar-based intervention; c) groups of study constituted by children with SLI, aged 3.0 to 12.0 years; d) design including Pre and Post measures; e) articles reporting quantitative/qualitative data analyses. The databases selected for this review were: Lilacs, PubMed, Embase, Scopus, ISI-Web of Science, and EBSCOhost.

Results: most studies reported interventions focused on expressive grammar, providing no particular details about the specific grammar contents considered. Interventions usually consisted of implicit approaches implemented as individual therapy. Studies reported children with SLI as generally improving on intervened skills.

Conclusion: all of the grammar-based intervention programs described in the selected studies, seemed to be equally adequate when working with children with SLI.

Keywords: Child Language; Language Disorders; Language Therapy; Speech, Language and Hearing Sciences

INTRODUCTION

Specific Language Impairment (SLI) is generally defined as a disorder of the linguistic development, which occurs in the absence of evident neurological damage, hearing deficit, severe environmental deprivation or mental retardation[1]. It has been estimated that this disorder affects approximately 7% of children[2,3] and that it persists until adolescence[4,5].

One of the most outstanding linguistic characteristics in children with SLI is their grammatical problems[6]. These are generally considered one of the nuclear symptoms of this disorder[7]. In addition, there are children with SLI who are characterized by only demonstrating difficulties in grammatical aspects[8].

Grammar difficulties occur both at an expressive and comprehensive level. In this regard, it has been observed that expressive morphosyntactic disturbances are more evident in young children (up to 8 years) and that receptive errors are expressed even in adolescence[9]. Although grammatical errors are a transversal symptom, difficulties may manifest differently in speakers of different languages[1,10]. For example, English-speaking children show mainly a compromise in the morphology of verbs, in particular related to the use of third person singular and to the morphemes of the past tense of regular verbs[11]. On the other hand, Spanish speakers, in addition to their difficulties with verbs, exhibit difficulties with the use of articles, clitic pronouns and prepositions[12-14].

The Procedural Deficit Hypothesis is one of the explanations proposed to understand the grammatical difficulties of children with SLI. This hypothesis states that grammar involves the learning of rules, which requires the use of procedural memory. Instead, lexical knowledge depends on declarative memory. In children with SLI, procedural memory would be compromised and therefore grammatical areas would be affected. In contrast, declarative memory would be unscathed[1].

The relevance of grammatical difficulties in children with SLI requires developing interventions that contribute to overcome or compensate this problem.

Kamhi[15] states that in therapy, there can be a differentiation between the approaches (referring to the how) and the contents (referring to the what) that should be used. Regarding the approaches, Ebbels[16] distinguishes two types: implicit and explicit. Implicit approaches address the teaching of grammatical aspects through procedures such as reformulation, imitation, expansion or modeling. This perspective seeks that children are able to infer morphosyntactic rules without being explicitly instructed. From this approach, it has been found that the use of reformulation is appropriate for children with SLI when programs with specific grammatical objectives are applied[17].

In turn, explicit approaches directly teach the rules of grammar, through procedures that involve metalinguistic reflection, which is generally based on visual clues[16]. It is argued that visual clues are useful to support the teaching of grammar, because children with SLI have strong visual skills[18].

According to Kamhi[15], the approaches just described correspond to the same intervention model that varies in intensity and specificity. Thus, at one end of the therapy specter would be the explicit approach in which specific grammatical structures are explicitly taught through metalinguistic reflection. At the other extreme would be the implicit approach where, through procedures such as modeling or reformulation, these structures are learned, without direct instruction.

Regarding which approach is best for children with SLI, it seems that the explicit ones would be more appropriate. This is because these children show difficulties with implicit grammatical learning, due to their issues in procedural memory[1,16]. On the other hand, declarative memory, based on explicit learning, would not be affected[1,16].

Also, it has been proposed that at different stages and ages children respond differently to each of these approaches. Thus, implicit approaches would be more suitable for young children[16], while explicit ones are more appropriate for older children[18]. The previous statement is consistent with a study in which speech therapists reported that the most used procedures vary according to the school period in which the child is. Thus, in pre-school stage, modeling is the most used procedure, followed by reformulation and imitation (implicit approach). In the school stage, modeling is practically not used and the most common procedure is explicit teaching (explicit approach)[19].

Finally, it is important to point out that implicit approaches fundamentally help children with morphosyntactic expression difficulties[15]. On the other hand, explicit approaches support mainly schoolchildren with receptive grammatical difficulties[16].

As previously stated, in addition to the approaches that are used in an intervention, there are grammatical contents that must be addressed[15]. The establishment of these contents should consider the language spoken by the child, since grammatical difficulties manifest

differently in each language[1,10]. In English, the contents most commonly addressed in the pre-school stage, according to language therapists, are plural form and verbs in present progressive. In the school period the contents most usually applied are regular and irregular verbs in the past tense, pronouns and plurals[19].

Another topic that has been discussed regarding grammatical intervention in children with SLI is the duration that the session should have for the treatment to be beneficial. Recent work shows that there are no differences between sessions that last fifteen minutes and the ones that last thirty minutes. Consequently, it is suggested to prefer a shorter session[20].

Despite the importance of treating grammatical difficulties in children with SLI, it is noteworthy that there are significant gaps in the literature on the effectiveness and efficiency of the intervention, both in children with receptive grammatical problems and those with expressive grammatical difficulties[16].

Thus, the question of how the intervention used to support grammatical development in children with SLI is, turns out to be relevant and valid. Therefore, the objective of this paper is to review the literature that addresses grammar intervention aimed at increasing morphosyntactic abilities in children with SLI.

METHODS

Literature search procedures

An integrative review of the literature was carried out between August and October of 2018. For this review, two procedures were used.

The first one consisted in researching the following databases: Lilacs, PubMed, Embase, Scopus, ISI-Web of Science and EBSCOhost. These were chosen because they address issues related to therapeutic intervention, grammar and SLI. Thus, some focus primarily on biological and medical sciences and others address content both related to philosophy and humanities. The cross-reference between databases that address medical and biological contents and the ones that address philosophy and humanities allowed to find the articles analyzed in this review.

The terms used for the search were traced in English and Spanish. English was chosen because it is the language in which most scientific works are disseminated. As a matter of fact, abstracts of articles published in any language count with an English translation. In addition to the aforementioned, it is known that evidence on grammar in children with SLI

has been obtained mainly from studies conducted with English speakers[21]. On the other hand, Spanish was privileged as it is the most spoken Romance language in the world[22]. Along with the above, most journals that address the issue of language difficulties in Latin America and Spain disseminate their articles in Spanish. finally, Brazilian magazines disseminate articles in Portuguese and English and some of them accept works in Spanish.

The terms used in English were: "classroom and grammar and intervention", "grammar and intervention", "intervention and grammar and SLI", "classroom and children and SLI and grammar", "grammatical and treatment and SLI". In turn, the words used in Spanish were: "sala de clase y gramática e intervención" "gramática e intervención", "intervención y gramática y TEL", "sala de clase y niños y TEL y gramática" and "gramática y tratamiento y TEL". The terms "intervention / intervención" and "treatment / tratamiento" were used because they involve the idea of therapy, support plans, programs and training. On the other hand, the words "grammar / gramática" and "grammatical / gramatical" were used since they include the concepts of morphology and syntax. The descriptor "classroom / sala de clases" was included, because when using only the descriptors "grammar / gramática", "intervention / intervención" and "SLI / TEL" very few articles were found. Thus, when considering it within the search, more studies emerged.

All descriptors were examined without limiting the search, with the exception of Scopus database, in which the search for all terms was limited to the option of "title, abstract and keywords", because when considering all fields, many articles appeared which did not relate to the topic.

For the rest of the databases, there was only restriction of the terms "Grammar and intervention". In the case of PubMed and Embase, the search was limited to the title and the abstract simultaneously. In ISI, Lilacs and Ebscohost, which did not present the simultaneity option, the exploration was restricted to the title. This is because when these terms were not limited, the number of articles without relation to the topic increased considerably.

The second procedure consisted in searching for articles from the ones already selected in the mentioned databases. Specifically, the references found in those articles were placed in the Google Scholar search engine. All those that appeared in the Related Articles

section were reviewed and those that met the inclusion criteria were selected.

Inclusion Criteria for articles

1. Articles must contain original data.
2. Articles should report on applications of grammar intervention programs exclusively for children with language difficulties.
3. Articles should have been published in the last 10 years, that is, between 2008 and 2018.
4. The research design should include: a) study group, b) evaluation pre and post program implementation and c) quantitative or qualitative analysis of the data.
5. The intervention must be carried out in preschoolers and / or in schoolchildren with SLI.
6. The age range of children with SLI should fluctuate between 3.0 years and 12.0 years.

Accepted articles and rejected articles

The databases showed 1,171 articles and 4 articles were found through the Google Scholar search engine, and 1,057 articles were excluded due to their titles, 73 for being duplicated, 15 after the revision of the abstract and 7 after reading the complete text. Finally, there were 23 articles left which met the inclusion criteria, consequently they were analyzed in their full version.

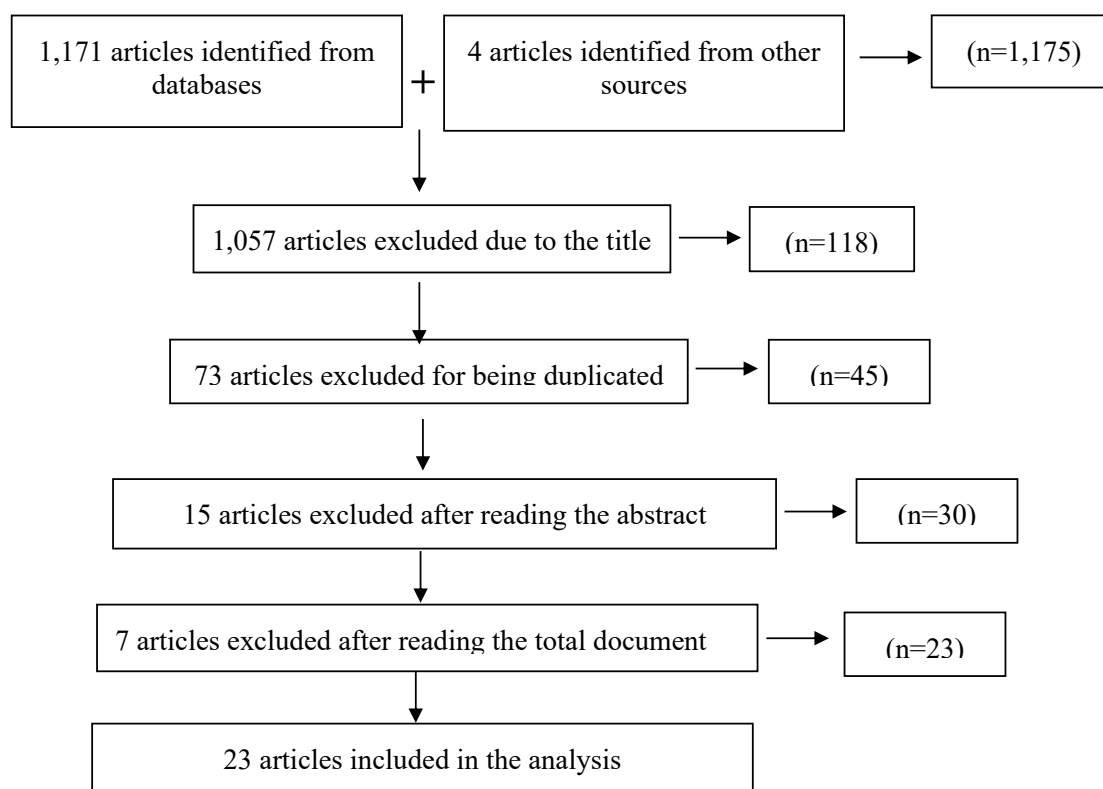Image 1 summarizes the search process performed for the selection of articles.

Figure 1. Flowchart for article selection

It should be noted that when the descriptors were tracked in Spanish, no results were obtained in any database. The only exception was EBSCOhost which when using the terms "sala de clases y niños y TEL y gramática" showed 10 articles. None were considered into the analysis, because they did not meet the inclusion criteria. Due to the aforementioned, the tables presented contain information on the articles that correspond to the search performed with the terms in English.

Table 1 shows the total number of articles found (number on the left) and the total number of articles selected (number on the right). Table 2 shows the distribution of the selected articles by their source. The numbers correspond to the ones under which they are found in the *references* section.

Table 1. Quantity and distribution of the articles found and selected, according to descriptor and database used

	Lilacs	PubMed	Embase	Scopus	ISI Web of Science	EBSCOhost
Classroom and grammar and intervention	0/0	16/4	13/2	49//3	61/0	93/2
Grammar and intervention	0/0	110/4	134/5	390/11	15/3	18/4
Intervention and grammar and SLI	0/0	26/6	11/3	23/6	39/12	35/5
Classroom and children and SLI and grammar	0/0	77/2	2//2	0/0	3/3	2/2
Grammatical and treatment and SLI	0/0	31/7	0	23/6	0/0	0

Legend: SLI (specific language impairment)

Table 2. Distribution of the selected articles, according to descriptor and source

	Lilacs	Pubmed	Embase	Scopus	ISI Web of Science	EBSCOhost
Classroom and grammar and intervention	0	25, 32, 36, 37	25, 36	25, 35, 36	0	25, 36
Grammar and intervention	0	25, 32, 36, 39	24, 25, 32, 36 39	25, 26, 27, 30, 32, 34, 35, 36, 39, 42, 45	32, 36, 42	32, 36, 33, 42
Intervention and grammar and SLI	0	25, 27, 28, 32, 37, 39	25, 36, 39	25, 26, 27, 32, 34, 39	25, 27, 30, 32, 34, 36, 37, 39, 41, 42, 43, 45	25, 31, 32, 34, 40
Classroom and children and SLI and grammar	0	25, 37	25, 37	0	25, 36, 37	25, 37
Grammatical and treatment and SLI	0	25, 27, 28, 31, 32, 40, 41	0	25, 27, 28, 31, 40, 41	0	0
Other sources:			23, 29, 38, 44			

Legend: SLI (specific language impairment)

REVIEW OF LITERATURE

Tables 3 and 4 can be found below, which summarize the most important information from the selected articles. The complete bibliographic information of the articles analyzed is in the *references* section and they are marked with an asterisk.

Table 3 shows the objectives / hypotheses, the participants to whom the grammatical intervention was applied and the language spoken by the children.

Table 3. Objectives/hypotheses, participants and language

Article Author/Year	Objective /hypothesis	Participants Language	Participants Experimental Group	Participants Control Group
Leonard L.B., et al. 2008[23]	To study three different interventions and observe the effects immediately after therapy and one month after the treatment is finished.	English	Experimental Group 1: The treatment focused on working 3rd person of the singular Experimental Group 2: Treatment focused on working with verb *to be*: *is, are, was*. Experimental group 3: Children received general language stimulation. In total, there were 33 children with SLI, aged between 3.0 and 4.8 years old. Each group completed one of the treatments. The analysis was performed on 8 children of each group.	
Leonard, L.B. et al. 2017[24]	To study the changes through time in the use of morphology of time and verbal consistency, in precision, diversity or productivity in children with SLI.	English	17 preschoolers with SLI. Range of age: 36-51 months old. Average: 42 months old.	
Motsch H, et al. 2008[25]	To investigate whether children with SLI, trained in *Context-Optimization* program during classes, achieved significative improvement in *case marking*. To investigate whether this therapeutic approach was more effective than traditional methods used on a control group.	German	63 children with SLI between 8.6 y 10.1 years old. They received *Context-Optimization* therapy for *case marking* (Accusative and Dative).	Control group: 63 children with SLI between 8.6 y 10.1 years old. They received a different therapy in *case marking* (accusative and Dative).
Camarata S, et al. 2009[26]	To examine if grammatical intervention focused on expressive grammar is associated with an improvement in receptive language.	English	21 children with SLI with receptive difficulties. Average age of 31 months.	6 children with SLI, with receptive language difficulties.
Yoder P, et al. 2011[27]	To know which grammatical intervention (1. *milieu language teaching* -MLT- and 2. *broad target recasts* -BTR) enables more the generalization and maintenance in time of grammatical aspects intervened in preschoolers with SLI.	English	Experimental group 1: 30 preschoolers with SLI who received BTR therapy. Experimental group 2: 27 preschoolers with SLI who received MLT therapy. In both groups the children must be between 30 and 60 months old.	-------
Yoder P, et al. 2013.[28]	To know how speech processing speed is related to grammatical intervention in children with SLI.	English	47 preschool children with SLI, with average age of 3.5 years old.	47 children with typical development of language, average age 3.5 years old.
Gallego JL. 2012[29]	To know if a grammatical stimulation program can modify the competence of students at a morphosyntactic level.	Spanish	16 children aged 5 years old with language impairment.	16 children aged 5 years old with language impairment.
Kulkarni A, et al. 2013[30]	To assess the effectivity of *Shape Coding* on the development of the past tense time morpheme "ed" in two school-aged children with language difficulties. To observe if the benefits achieved in therapy are generalized to spontaneous speech.	English	1 child with SLI and one child with ASD. One aged 9 years old and the other 8 years old.	
Hoover J, et al. 2013[31]	To compare treatment gain and generalization in two groups of children with SLI who participated in a grammatical intervention that differs in verb density.	English	6 children between 4.0 y 5.9 years old with SLI. Experimental group 1: 3 children who received intervention on third person of the singular with rare verbs. Experimental group 2: 3 children who received intervention on third person of the singular with dense verbs.	

| Article | Objective /hypothesis | Participants | | |
Author/Year		Language	Experimental Group	Control Group
Washington K, 2013[32]	To determine whether expressive grammar intervention enables social and emerging alphabetization. To determine whether the gains in expressive grammar and / or initial expressive grammar level predict the results in social and emerging alphabetization.	English	Experimental group 1: 11 children with SLI who received intervention through a computer. Experimental group 2: 11 children with SLI who were trained in a conventional, clinician-client modality.	12 children with SLI between 3 and 5 years old who did not receive treatment.
Washington K, et al. 2013[33]	To determine if the intervention in expressive grammar (both by computer and table top intervention) generates an accelerated growth of grammatical development and decrease of errors in grammatical categories compared to a group of children who do not receive intervention.	English	Experimental group 1 (Computer-assisted): 11 children with SLI between 3.11 and 4.6 years old. Experimental group 2: (Table-top) 11 children with SLI between 4.2 and 4.10 years old.	12 children with TEL between 3.6 and 4.10 years old.
Washington K, et al. 2013[34]	To investigate possible differences of interventions that provided diverse types of visual support, on the results in expressive grammar.	English	Experimental group 1: 11 preschoolers between 3.11 and 4.10 years old stimulated with the program CAI *Computer-assisted intervention).* Experimental group 2: 11 preschoolers between 3.11 and 4.10 years old stimulated with the program TTI *(Table-top intervention).*	-----
Smith-Lock K, et al. 2013[35]	To compare the effectivity of a treatment aimed at expressive grammar in children with SLI aged 5 years old, in different frequencies: 8 daily sessions or 8 weekly sessions.	English	Experimental group 1: 18 children aged 5 years old with SLI with daily therapy. Experimental group 2: 13 children aged 5 years old with SLI who received weekly therapy.	----
Smith-Lock KM, et al. 2013[36]	To assess the effectivity of a school intervention program for expressive grammar in children with SLI aged 5 years old.	English	19 children aged 5 years old with SLI with treatment for expressive grammar.	15 children aged 5 years old with control therapy: regular program from the school, centered in preposition comprehension.
Smith-Lock KM et al. 2015[37]	To compare the effectivity of two planned modalities of feedback: "*recasting approach*" versus "*cueing approach*"	English	Experimental group 1: 14 children aged 5 years old with SLI who received "*cueing approach*" Experimental group 2: 17 children aged 5 years old with SLI who received "*recasting approach*"	-----
Plante E, et al. 2014[38]	To compare two treatments: high variability and low variability on the learning of grammar in children with SLI. Hypothesis: 1. The gains for stimulated morphological forms will be greater than for non-intervened morphemes in any of the two treatments. 2. The use of 24 unique verbal sources (high variability condition) would produce greater treatment effects than the use of 12 unique verbal sources.	English	Experimental group 1: 9 children with SLI between 4.0 and 5.11 years old on a 'low variability' therapy which implies intervention based on the use of 12 verbs. Experimental group 2: 9 children with SLI between 4.0 and 5.11 years old on a 'high variability' treatment which implies the use of 24 verbs.	

Article	Objective /hypothesis	Participants		
Author/Year		Language	Experimental Group	Control Group
Hsu HJ, et al. 2014[39]	To know whether comprehension of short reversible sentences can be improved through computer-based training. To know if the learning process in children with SLI is similar to the one in younger children with typical development.	English	28 children with SLI between 6 and 11 years old.	Control group 1: 28 children with typical development aged 4 to 7 years old who were paired with the group with SLI on gross results for the receptive grammar test. Control group 2: 20 children with SLI, with the same tests but without therapy.
Zwitserlood R, et al. 2015[40]	To examine the effectivity of a combined metalinguistic and multimodal approach on a more advances school age in children with SLI.	Dutch	12 Dutch children with SLI with an average age of 11 years old.	
Meyers-Denman Ch., et al. 2016[41]	Hypothesis 1: Intervention of an objective morpheme generates a statistically significant improvement (independent of which of the treatments is applied). Said gain is not to be observed on non-intervened morphemes (control morphemes). Hypothesis 2: There may be a difference according to the treatment dosage between both groups. Hypothesis 3: The results obtained may vary on a longer term.	English	Experimental group 1: 8 children with SLI between 4 and 5 years old, with a median of 5.4 years old, on a continued 30 minutes therapy. Experimental group 2: 8 children with SLI between 4 and 5 years old, with a median of 5.3 years old, on a spaced treatment, 3 times 10 minutes in a 4 hour time frame.	
Calder S, et al. 2017[42]	To investigate the efficacy of combined explicit and implicit intervention techniques, delivered by a Speech therapist to improve receptive and expressive intervention, including the use of past tense.	English	3 children between 6 and 7 years old with an alteration in language development.	
Owen, A. et al. 2017[43]	To determine whether starting the treatment with phonologically simple, frequent and telic verbs (easy verbs) or with phonologically complex, infrequent and atelic verbs (difficult verbs), enables a greater progress in children with SLI, in their production of trained or untrained verbs.	English	18 children with SLI. Experimental group 1: 10 children on the treatment initiated with easy verbs. Average age: 63.1 months. Experimental group 2: 8 children on treatment initiated with difficult verbs. Average age: 72.75 months.	
Owen et al., 2018[44]	To update the results of the Owen et al., 2007 study. Such update included three additional children in the sample.	English	20 children. Of these, 17 correspond to Owen et al., 2017. Experimental group 1: 10 children on the treatment initiated with easy verbs. Average age 64.7 months. Experimental group 2: 10 children on the treatment initiated with difficult verbs. Average age 70.8 months	
Ramírez-Santana G, et al. 2018[45]	To study the effects of an intervention program designed to improve grammatical abilities in students with SLI.	Spanish	34 students diagnosed with SLI (average age 8 years old).	34 children with typical language development (average age 7.9 years old)

Legend: SLI (specific language impairment) / ASD (autistic spectrum disorder) /MLT (*milieu language teaching*) /BTR (*broad target recasts*) / CAI (*Computer-assisted intervention*) / TTI (*Table-top intervention*)

The data in Table 3 indicate that 83% of the researches are carried out in English-speaking children. This implies a limitation because the results cannot always be extrapolated to children who speak other languages, since the grammatical difficulties in children with SLI manifest differently in each language[10]. This is consistent with what has been previously stated by Leonard[21], regarding the fact that the greatest amount of information about grammar comprehension in children with SLI has been obtained from studies with English speakers.

Another noteworthy aspect is that 87% of the interventions focus on supporting expressive grammar. These findings agree with what Ebbels'[16] proposes, which indicates that there are persistent gaps in the intervention, in particular in treatments aimed at receptive aspects. It is important to note that 3 investigations (in which the therapies were not focused on grammatical comprehension) showed that children also benefited at a comprehensive level. Thus, the work of Calder et al.[42], which uses combined approaches, Zwitserlood et al[40], which uses the metalinguistic approach and Camarata et al.[26] that uses implicit approaches to work expressive grammar, indicated that children were favored both expressively and comprehensively. These results suggest that the approach to grammatical comprehension can be performed indirectly, in particular the explicit or metalinguistic approach seems to be useful for receptive grammatical difficulties. Ebbels[16] also agrees that explicit approaches are appropriate to support students with receptive grammatical difficulties.

In addition, it can be observed that the age ranges are different in the studies. Thus, it is appreciated that 78% of the participants are preschoolers whose ages range between 2 and 6 years old. Moreover, in 26% of the studies the subjects are under 5 years old, which is controversial since before this age the diagnosis of SLI is debatable. This is because it is possible to confuse this diagnosis with a language delay. This may impact the results of the investigation, given that children with language delay generally progress faster than children with SLI when an intervention program is applied[45].

Regarding the type of studies, it is observed that 83% of them compare independent samples, that is, they contrast groups that receive different types of interventions or groups with different diagnosis (SLI and TD) to which the same intervention is applied.

Table 4 shows the characteristics of the treatment and the conclusions obtained after the intervention.

The characteristics of the treatment were analyzed using the following categories: modality (individual and group), dose (number of sessions, session length and duration of treatment), approach and intervention techniques or procedures. The elements referred to the dose are relevant to specify the nature of the treatment[16]. Finally, it is important to note that the approach was inferred from information about the techniques or procedures of the treatment.

Table 4. Characteristics of the treatment and conclusions of the intervention

Article			Experimental group treatment		Conclusions
Author/Year	Frequency	Individual/group	Approach	Techniques/Procedures	
Leonard L, et al. 2008[23]	4 weekly sessions of 30 minutes each. 96 sessions were performed in 24 weeks.	It is not specified in the article but it can be inferred that it is individual.	Implicit	3 programs were developed. In two of them a specific *agreement morpheme* was stimulated in a focused manner and in the third one general language was stimulated. Each one of them consisted in two activities. The first one consisted in telling a story using toys that performed the scenes, where the structures to be stimulated were used (12 times). The second one consisted in a conversation where using a game, reformulations were made (12 reformulations). In the group that received a general stimulation of language, third person of the plural was used for the story and for the conversation. Both group 1 and 2 showed an improvement after intervention and did not regress after one month.	Both group 1 and group 2 improved after the intervention and did not regress after one month. In the group of children who had global intervention the results in general terms were lower. It is concluded that a grammatical intervention with objective morphemes is better than addressing grammatical stimulation globally.
Leonard, L. el al. 2017[24]	96 sessions: two times per week	individual	Implicit	Treatment was based on implicit approaches. The session was divided in two parts. In the first part the clinician read a story to the child, represented with dolls. In each story the third person singular appeared 12 times on at least 6 different verbs. Once the reading was over, the second part started, using reformulation. Using the past tense "ed", copulative and auxiliaries "is", "are","am", "was" and "were" was avoided.	Children's language samples indicated that the group had an increase in the use of past tense morphemes, auxiliaries, the third singular person and verbal consistency. In addition, an increase in time use and concordance with limited diversity and productivity was observed in the initial measures. In the latest measures it is observed that increase in diversity and productivity occurs with little change in accuracy.
Motsch H, et al. 2008[25]	12 hours of therapy. The sessions lasted 17 minutes, 4 times per week, for 12 weeks.	Common classroom most of the time. The support was given in a group or individual setting, on some occasions.	Implicit	*Context-Optimization* (CO) intervention strategy. It is a method of grammatical facilitation that optimizes naturally presented contexts. Children are required to focus on the objective structure. The processing and structure chosen is made explicit. In this method the professional adapts the articulation, facilitating the perception with extensions, intonations, etc. There is a varied use of resources to support children. In the control group modeling approaches were used to support students, for example, corrective feedback.	Classroom CO therapy is effective for both accusative and dative, while traditional methods are only effective for accusatives. The group to which CO was applied achieved better performance than the control group, to which a traditional method was applied.
Camarata S, et al. 2009[26]	24 sessions for 12 weeks. Two times per week, for one hour.	Individual therapy at a treatment center.	Implicit	The intervention techniques used were imitation, modeling, conversational reformulation and Milleu Teaching (teaching of the middle). The description of this method is found in the article by Yoder et al, 2011.	The group of children who had expressive language intervention showed a significant increase in receptive language scores. These gains were significantly greater than those observed in the control group.

Article			Experimental group treatment		Conclusions
Author/Year	Frequency	Individual/group	Approach	Techniques/Procedures	
Yoder P, et al. 2011[27]	30 minutes sessions, three sessions per week, for 6 months.	At a university clinic, individual sessions.	Implicit	Two methods of grammatical intervention were used: Milieu language teaching (MLT): a system of gradual and environmental aids is used to generate specific linguistic structures and functional or verbal rewards. The context was directed game. For example, if a child at the one-wordstage says "ball" while stretching to take a ball, the adult may hold the ball while looking expectantly at the child. If the child does not respond, the adult may ask: "What do you want?" If the child still does not respond while looking at the ball the adult can say: "Say, 'I want the ball'", provoking an imitation request. If the child says: "I want ball," the adult could say, "You want the ball" and give the child the ball. An aid is provided only to obtain the desired response, and once this aid is obtained it disappears. *Broad target recasts* (BTR): This intervention is based on the child's play, talk revolves around what the child is paying attention to, the child is asked about what they are doing and *recast* is doneconcerning what the child said. This means that much of the child says is repeated, but adding grammatical and semantic content. The child is not forced to produce a specific grammatical expression. In short, MLT and BTR are child centered. Both use*recast* as a result of the child's expressions. MLT uses a previously selected target grammar structure level, while BTR uses grammar targets selected in the moment. MLT seeks to obtain an immediate production of the given model or imitate the *recast*, which does not occur in BTR.	MLT enablesan improvement in Grammar, more than BTR in children who were initially in Stage I of Brown. The effects are maintained 5 months after the end of the treatment.
Yoder P, et al. 2013[28]	30 minutes sessions, three sessions per week, for 6 months	At a university clinic, individual sessions.	Implicit	In the experimental group some children received therapy with Milieu language teaching (MLT) and others with Broad target recasts (BTR).	Speech processing speed was higher in children with typical development, before treatment. After 6 months of treatment, children with SLI increase their speech processing speed. This processing speed did not show differences between both types of treatment. The change in Speech processing speed is positively related to the improvement rate of grammar during treatment in the group of children with SLI.
Gallego JL. 2012[29]	1 weekly session of 30 minutes. The number of weeks is not informed.	In small groups and on some occasions, there was individual intervention with children who presented a slower learning rhythm and progress.	Implicit	*Program for the Development of Morphosyntax* (PO. DE.MOS). This is an open program that is structured around five series with which different basic grammatical structures are stimulated. The difficulty of the activities is progressive. It is pointed out that it is not a grammar program, but an expression program, formulated in grammatical terms. When the child made a mistake in one of the stimulated structures, direct correction was avoided, since first there was an attempt to help them notice the error through questions. If this did not happen, the error was corrected and explanations were delivered. Care was taken to positively reinforce children's achievements.	There are significant differences between the groups,fact thatis attributed to the PO.DE.MOS program. It is indicated that this program was useful for increasing morphosyntactic skills in the children who were intervened.

Article			Experimental group treatment		Conclusions
Author/Year	Frequency	Individual/group	Approach	Techniques/Procedures	
Kulkarni A, et al. 2013[30]	Once a week for 10 weeks, sessions of 30 minutes. An assistant was present during the sessions, who repeated it during the week, but at home. The therapy was suspended for 6 weeks. Then, it was resumed for 5 more sessions.	The first 10 sessions were individual. Of the last 5 sessions, 4 were in the classroom with a communication partner and 1 of them at home with the parents. There was also a meeting only with parents.	Explicit	The individual sessions progressed as follows: 1. Introduction to *Shape Coding* 2. Word identification 3. Clarification of the present versus the past 4. Introduction of the arrows to mark forms 5. Completion of sentences and correction of written and spoken errors 6. Production of written and spoken sentences.	One of the participants improved significantly in the completion of sentences, which was used to measure the progress through the sessions, but the generalization was only achieved after specific activities aimed at generalization. The other child made more modest progress in completing sentences and seemed to generalize without resorting to directed activities.
Hoover J, et al. 2013[31]	2 sessions of 30 minutes every week, for 6 weeks. Each child received 12 sessions.	It is not specified in the article but it can be inferred that it is individual.	Implicit	Therapy began with a short story which was supported with pictures of the verbs to work (6 verbal presentations per story). Then the examiner obtained productions by verb, by means of a combination between direct repetition and spontaneous production. When a child omitted the target structure, the examiner rephrased the sentence. Each child received 72 exposures to the structure (36 through auditory exposure and 36 through child production and reformulation). The treatments only differed in the verbs used.	The gains in treatment and generalization were greater for children with the treatment of rare verbs.
Washington K, 2013[32]	10 interventions of 20 minutes, once a week.	11 children through a computer. 11 children on clinician-client therapy.	Explicit	11 participants received computer-assisted treatment. A software was used called *My Sentence Builder* (Washington and Warr-Leeper, 2006). This program presents the necessary elements to create a present progressive sentence. In addition, each element of the sentence has a visual representation. Children are supported and guided by the speech therapist. The other 11 participants had a conventional treatment. Visual support was given through pages of books, objects, and illustrated cards with actions to facilitate grammatical productions in a game format. To facilitate the understanding of the elements of the sentence, prosodic emphasis was placed on each of them. The social skills and knowledge of letters, words and books (print concept) were addressed in the same session in which the grammar content was worked on in both groups.	Both groups of participants who received grammatical intervention were positively affected in social skills and *print concept*. This did not happen in the control group. These gains were maintained 3 months after the intervention.
Washington K, et al. 2013[33]	20 minutes sessions, once a week for 10 weeks.	11 children through a computer. 11 children on clinician-client therapy.	Explicit (computer) and Implicit (Board game)	One group was assisted by computer (My Sentence Builder) which has visual aids to represent semantic and syntactic elements of the sentence. Besides this there was modeling and repetition. For another group there was table-top intervention. In this group the therapist made verbal and non-visual emphasis on grammar and there were specificaids only for the semantic elements of the sentence.	Both intervened groups obtained better results than the non-intervened group. These differences were maintained over time. The two interventions did not differ statistically.
Washington K, et al. 2013[34]	20 minutes sessions, once a week, for 10 weeks.	11 children through a computer. 11 children on clinician-client therapy.	Explicit (CAI) and Implicit (TTI)	Two methods were used: Computer Assisted Intervention (CAI) and (TTI). The difference was that the first one incorporated visual support for both semantic and grammatical sentences while TTI included only visual support for semantic elements and emphasis on grammatical elements. The fundamental difference between the interventions were the types of visual support: In the CAI, the *My sentence builder* program was used (each syntactic element had a figure or color). The TTI used images and toys. In both programs, in addition to the visual, modeling, repetition, a significant context and a game format were used.	The group that used CAI outperformed the TAI group in efficiency and syntactic growth. This study showed that the use of multiple visual aids in expressive grammar training enabled a therapeutic advantage in grammar learning from session to session for preschoolers with SLI.

Article			Experimental group treatment		Conclusions
Author/Year	Frequency	Individual/group	Approach	Techniques/Procedures	
Smith-Lock K, et al. 2013[35]	For both experimental groups therapy lasted 1 hour. 8 sessions were performed. Group 1 had daily sessions and group 2 weekly sessions.	A first instruction directed at the whole classroom. Then small groups within the common classroom (3 to 5 children, according to performance).	Implicit	The speech therapist conducted a group lesson with one objective and then each group performed 3 activities for their specific objective. The sessions consisted of game-based activities. Focused stimulation techniques: modeling, imitation, direct teaching and reformulation.	The expressive grammar intervention was most effective when the frequency of the sessions was weekly.
Smith-Lock KM, et al. 2013[36]	1 weekly session of 1 hour for 8 weeks.	A first instruction directed at the whole classroom. Then small groups within the common classroom (3 to 5 children, according to performance).	Implicit	The speech therapist conducted a group lesson with one objective and then each group performed 3 activities for their specific objective. The sessions consisted of game-based activities. Focused stimulation techniques: modeling, imitation, direct teaching and reformulation.	Grammar performance improved after grammar treatment. The group of children who received a control intervention showed no differences after treatment.
Smith-Lock KM et al. 2015[37]	1 weekly session of 1 hour, for 8 weeks.	A first instruction directed at the whole classroom. Then small groups within the common classroom (2 to 5 children, according to performance).	Implicit (*recasting approach*) and Explicit (*cueing approach*)	The Speech Therapist conducted a group lesson with an objective. Then, each group did 3 activities for their specific objective. The sessions consisted of recreational activities. In both groups if the child responded correctly, the teacher or speech therapist directed them to provide another model of the goal and some phrase like «very good.» Treatments differ when the child makes a mistake. In the recasting approach group, after an error the correct answer was delivered, but without trying to get the child to produce it properly. In the cueing approach group if the child was wrong, the teacher or speech therapist followed a hierarchy of signals designed for the child to produce the correct answer. These signals progressively provided more support.	*Cueing approach* led to a greater treatment effect than *recasting approach.* The success of the treatment was not related to the grammatical objective that was stimulated in the intervention.
Plante E, et al. 2014[38]	Daily 30 minutes therapy sessions, until completing 24 sessions.	Individual therapy.	Implicit	The treatment consisted of reformulation in conversation. The children were assigned one of two therapyoptions: One of high variability where 24 verbs were used in which reformulation was delivered in the conversation and one of low variability where 12 verbs were used and each reformulation given twice. The sessions had different materials and the children selected them depending on their interest. Example: dialogic book, reading, board games, craft projects, costumes, flash cards, activitiesand free play. There were 3 activities per session. Reformulation was defined as an issuance of the clinician which was followed by an attempt of the child that could be right or wrong. Right and the wrong were reformulated. In both treatment conditions, clinicians created contexts in which the child should use the objective morpheme.	The condition of high variability only produced significant changes in the use of morphemes trained in children, but not in other morphemes. More children in the condition of high variability than in the one of low variability showed an effect ofthe treatment and on the production of expressions containing the treated morphemes.

Article			Experimental group treatment		Conclusions
Author/Year	Frequency	Individual/group	Approach	Techniques/Procedures	
Hsu HJ, et al. 2014[39]	One session per day for a period between 4 and 6 days. Each session lasted between 5 and 7 minutes.	Each child with a computer. Individual	Explicit	The computerized training program was based on the one used by Bishop, Adams & Rosen (2006). The children moved some images either up / down or before / after in relation to the sentence they heard. A format similar to a game was adopted using an error-free learning procedure. If the child gave a correct answer there was a visible reward. If theyanswered incorrectly, the child had the opportunity to try again.	Control group 1 was eliminated from the analysis because all but 1 child scored over 90% in the pretreatment. The children to whom the program was applied, showed better performance in repeated sentences than in the sentences presented only once. Overall, children's scores improved with training, with the exception of the TROG-E test (receptive grammar) in which neither children with SLI nor their controls showed improvement in grammatical agreement. The training used in the study was not enough to make the performance of children with SLI equal to a group of children with typical development of the same age.
Zwitserlood R, et al. 2015[40]	Twice a week for 5 weeks. 10 sessions in total. 5 hours in total.	Individual	Explicit	MetaTaal metalinguistic intervention approach. It uses images to represent coordination or subordination. The instruction was mostly verbal. Minor reading and writing activities were included. Conversations, photos, stories were used to elicit the children's production. Each therapy session also had a game activity to consolidate the syntactic structures that were being stimulated.	This study supports the evidence that grammar skills in older school-aged children with SLI can be remedied by direct intervention using a metalinguistic approach. It is noted that 5 hours of intervention in 5 weeks, with a metalinguistic training, can contribute to the improvement of the production of relative clauses in school-age children, but not in their understanding.
Meyers-Denman Ch., et al. 2016[41]	For both experimental groups the therapy was daily and lasted 30 minutes, for 5 weeks. For group 1 the 30 minutes were continued and for group 2 it was divided in 3 sessions of 10 minutes each, within 4 hours.	Individual	Implicit	To determine the appropriate target morpheme, during the first three days, 4 to 6 morphemes were tested for each child. The clinicians had to cause the child to issue the morpheme 10 timesin conversation, through play. Two morphemes were selected, one of them would be treated (objective morpheme) and the other tracked but not treated (control morpheme). The clinician rephrased the conversation with the child focused on the morpheme to be treated, performed 1 time (called simple reformulation). When performing the correct reformulation, the clinician did not ask the child to say it again or correct if they repeated the error. The dose was 24 reformulations per day (8 every 10 minutes) directed to a specific grammatical morpheme. The clinicians were free to select the activities that seemed appropriate and entertaining for the children but had to perform at least three different activities per day with varied material. Before the reformulation the clinician had to make sure he had the child's attention.	Treated morphemes showed more improvement than untreated ones. The children who received therapy under the condition of 30 continued minutes showed no difference from those who received the 30 minutes in interventions of 10 minutes each in a period of 4 hours. Regarding long-term performance, children were assessed between 7 and 11 weeks after treatment. There were no differences in the performance of the target morpheme between groups.

Article			Experimental group treatment		Conclusions
Author/Year	**Frequency**	**Individual/group**	**Approach**	**Techniques/Procedures**	
Calder S, et al. 2017[42]	10 sessions. During 5 weeks, two times per week. 45 minutes sessions.	Individual	Explicit	The treatment was based on explicit grammatical intervention approaches using the Metacognitive training techniques of *Shape Coding* (Ebbels, 2007) which was combined with a hint hierarchy procedure, called *Cueing hierarchy*.	Two of the three participantsadvanced in the standardized tests for receptive and expressive grammar. One participant continued to improve five weeks after treatment in expressive grammar. The findings suggest that this approach was effective.
Owen, M. et al. 2017[43]	36 visits maximum. Ranging between 12 and 36 visits, of approximately 45 minutes each.	Individual	Implicit	The treatment was based on implicit approaches. The visits included three parts: imitation of sentences, modeling and reading stories represented with toys. In a latter instance, reformulation wasused. In each of these parts the focus was verbal morphology.	Children who began therapy with more difficult verbs hadbetter results than those who began with easier verbs. Improvement is observed both in verbs that were trained and in verbs that were not trained.
Owen, A. et al., 2018[44]	36 visits maximum. Ranging between 13 and 36 visits, of approximately 45 minutes each.	It is not specified in the article but it can be inferred that it is individual.	Implicit	Same treatment performed in the study by Owen et al., 2017	Children who started therapy with the condition of difficult verbs showed a greater improvement in the use of the «ed» morpheme for the past tense of regular verbs. This gain was observed in both language samples and structured assessments.
Ramírez-Santana G, et al. 2018[45]	216 sessions of 40 minutes each, two times per week.	It is not specified in the article but it can be inferred that it is individual.	Explicit	The program combines fictional stories with morphosyntactic activities. In the first part (30 min), the retelling of fictional stories is sought. For this, the child is told a story with icons supporting it. Then the child is asked to retell it. The next step is telling the story without the help of icons. If the child omits information or makes mistakes, the therapist uses strategies such as questions or grammar activities in which reformulation is performed to model and correct. The materials that were used were: sheets, comics or cartoons that represent the story, different stories, icons that represent the basic categories of the narrative structure, cards and pictograms, stickers to generate stories, notebooks and pencils. In a second part (10 min), the creation of stories is sought. Specific morphosyntax activities are conducted aimed at the adequate production of different syntactic structures. This part uses sheets containing graphic organizers or icons that include all the elements of the formal structure in sequential order and in separate squares. Grammar facilitation procedures such as modeling, reformulation, vertical structuring and imitation are delivered. The most specific work of grammatical production involves a series of morphosyntactic activities aimed at facilitating the knowledge, understanding and production of different syntactic structures. Activities were used such as completing sentences, crossing out the incorrect words in sentences, sorting sentences presented in a disorganized manner, organizing and verbalizing sequences of actions using drawings, placing sentences on their respective balloons, organizing sentences with the help of cards and using graphic supports to associate a phrase with its drawing. For this, materials such as comics, exercise cards and card kits are used.	The group with SLI improved compared to controls, because they reduced the number of ungrammatical sentences, which was reflected in the decrease in syntactic and morphological errors.

Legend: CO (Context-Optimization) / MLT (milieu language teaching) /BTR (broad target recasts) /SLI (specific language impairment) /PO.DE.MOS (*Programa para el Desarrollo de la Morfosintaxis*) /CAI (Computer-assisted intervention) /TTI (Table-top intervention)

Table 4 shows that 60% of the studies are carried out individually. This suggests that there is some consensus that individual therapy is more appropriate for children with SLI than group therapy. This may be due to the fact that the persistence and severity of this disorder would require focused support for these children. This result differs from a study[46] in which it was found that the individual modality shows a similar effect as group therapy. It should be noted that in the mentioned study each subject had their own therapeutic goal. Consequently, the results, rather than favoring a treatment modality, indicate the importance of the intervention being specific and directed to a particular grammatical aspect.

Regarding the frequency and duration of the sessions, it is noted that 65% of the studies perform between 1 and 2 sessions per week and their duration is variable, fluctuating between 5 minutes and 1 hour. It is noteworthy that the highest percentage was 39%, which corresponds to studies that carried out therapy sessions of 30 minutes.

In relation to the length of the treatment, the data shows that the duration ranges from 1 week to 8 months. However, there is a tendency to execute treatments that last between 10 and 12 weeks. It is important to note that the Ramírez-Santana[45] study implements the treatment for more than 1 year.

Despite the importance of evaluating the dose (number and duration of sessions / length of treatment), it was found that only the study by Smith-Lock et al[35] analyzes some aspects of it. The purpose of this study was to determine which dose was most effective. Their results showed that weekly therapy, carried out for 8 weeks, was more effective than daily treatment. The findings of this investigation are consistent with what was raised by Kamhi[15]. This author mentions that a higher dose in therapy will not always lead to better results. It is suggested that progress may depend on other aspects such as the area to be supported and the level of development that the child manifests in that area.

This is also consistent with what is proposed by Proctor-Williams and Fey[47] who express that therapy is effective when it provides varied and repeated learning opportunities that are distributed over a considerable period of time.

In relation to the approaches used, there is a tendency to perform the intervention with one type of approach. Thus, 60% of the studies were carried out with the implicit approach, 26% used therapies with the explicit or metalinguistic approach and 14% used both approaches. The results of the investigations showed that children in treatment, independent of the approach, show improvements in the areas that are stimulated. These findings are not in accord with the proposal by Ullman & Pierpont[1] and Ebbels[16] in which the metalinguistic approach would be better for children with SLI, since this approach is based on declarative memory, which is not compromised[1].

The predominance of treatments that use implicit approaches may be due to the age of the subjects who are supported with such treatments. Thus, 13 of the 14 studies in which the implicit approach is used work with participants who are under 6 years old. In contrast, of the 6 works in which the explicit approach is used, 5 were applied to children who were 6 years old or older. This relationship between age and type of approach is consistent with what is proposed by Ebbels[16,18]. The author indicates that implicit approaches are more suitable for younger children[16] and explicit ones are more suitable for older children[18].

Finally, it is important to note that the studies analyzed do not show explicit criteria to determine the contents that will be applied in therapy. In general, syntactic structures are mentioned, but their selection is not substantiated. This indicates that this aspect of therapy is not a focus of attention when assessing the treatments.

The limitations of this review are related to the age of the subjects and one of the inclusion criteria. The age range to which the search was limited restricted the analysis of interventions for older children with SLI. In this regard, it is important to review treatments in older subjects, because the linguistic aspect of grammar acquires relevance when learning the written language. The inclusion criterion which considered studies exclusively with grammatical interventions, limited the analysis of treatments where the grammatical component works in conjunction with other linguistic aspects in children with SLI.

CONCLUSION

The review of the articles shows that in 10 years of studies analyzed, research on grammatical treatments in children with SLI is scarce, since only 23 articles were found using the established criteria. In addition, most of them have been done with English-speaking children. Regarding the modality and the dose, the treatments tend to be individual, predominantly with therapies of one or two weekly sessions of 30 minutes.

The intervention period tends not to exceed 6 months. Concerning the approach, most treatments use the implicit therapy and the results indicate that children with SLI benefit from any type of approach. In regards to the intervention of expressive or comprehensive aspects, there is a prevalence of studies in which expressive grammar is intervened. Finally, aspects related to grammatical contents are not specified. This suggests that there is a gap regarding the criteria applied to select the grammatical contents that can be used to support the morphosyntactic difficulties in children with SLI.

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