



# Study on Language Production in Children with Cerebral Palsy Augmentative and Alternative Communication Users

Estudo sobre produção de linguagem em crianças  
com paralisia cerebral usuárias de Sistemas de  
Comunicação Aumentativa e Alternativa

Estudio sobre producción del lenguaje en niños con  
parálisis cerebral usuarios de Comunicación  
Aumentativa y Alternativa

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## Abstract

Children users of Augmentative and Alternative Communication Systems (AACS) suffer from significant impairments in complex language production, in the construction of personal or fictional narratives. The socio-constructivist approach to development has supported the view that narratives are crucial for the construction of personal and social identity (Booting, 2002; Bruner, 2004). The present case study analyzes the linguistic production in three children with cerebral palsy users of AACS during shared reading sharing. Three main aspects of interactions are analyzed: (a) the characteristics of language produced by children, including grammatical and semantic complexity and lexical type, (b) the strategies used by teachers to encourage narrative production, and (c) how AACS are used to boost linguistic production. Our findings illustrate the difficulties faced by these children. In the three cases, linguistic production is restricted to extremely simple sentences (of one word in most cases) and a lack of children's initiative is observed during an interaction. The results point toward the need of developing a better implementation of bootstrapping technics for narrative elicitation, taking into account the intrinsic limitations of AACS.

## Palabras clave

augmentative and alternative communication; cerebral palsy; special education; language production; narrative construction

## Keywords

comunicação aumentativa e alternativa; paralisia cerebral; educação especial; produção de linguagem; construção narrativa

## Resumo

As crianças que usam sistemas de comunicação aumentativa e alternativa (SCAA) enfrentam dificuldades significativas na produção d linguagem complexa, principalmente, na construção de narrativas ficcionais e pessoais. A aproximação sócio-constructivista do desenvolvimento realizou uma ampla contribuição teórica que mostra o importante papel das narrativas no estabelecimento da identidade pessoal e social (Booting, 2002; Bruner, 2004). O presente estudo de caso analisa a produção linguística em três crianças com paralisia cerebral que usam SCAA em sessões de leitura compartilhada. Três aspectos fundamentais são analisados: a) as características da linguagem das crianças em seus aspectos gramaticais, bem como a complexidade semântica dos significados produzidos; b) as estratégias utilizadas pelas professoras para promover a produção da linguagem nas crianças e; c) como os SCAA usados pelas crianças ajudaram ou limitaram a produção linguística. Nossos resultados ilustram as dificuldades enfrentadas por essas crianças, pois nos três casos, a produção é limitada a frases extremamente simples (principalmente monossilábicas) e é observada falta de iniciativa e uso de turnos durante a interação. Os resultados apontam à necessidade de desenvolver uma melhor implementação das técnicas de elicitación narrativa pelo interlocutor, levando também em consideração as limitações intrínsecas dos SCAA.

## Resumen

Los niños que usan sistemas aumentativos y alternativos de comunicación (SAAC) experimentan dificultades significativas en la producción del lenguaje complejo, en particular, para construir narraciones ficticias o personales. La aproximación socio-constructivista al desarrollo ha realizado un amplio aporte teórico que muestra el importante papel de las narrativas en el establecimiento de la identidad personal y social (Booting, 2002; Bruner, 2004). El presente estudio de caso analiza la producción lingüística en tres niños con parálisis cerebral usuarios de SAAC en sesiones de lectura compartida. Tres aspectos fundamentales son analizados: a) las características del lenguaje de los niños en sus aspectos gramaticales, así como la complejidad semántica de los significados producidos; b) las estrategias usadas por las maestras para fomentar la producción de lenguaje en los (las) niños(as), y c) de qué forma los SAAC usados por los niños ayudaban o limitaban la producción lingüística. Nuestros hallazgos ilustran las dificultades enfrentadas por estos niños. En los tres casos, la producción se limita a oraciones extremadamente simples (en su gran mayoría una palabra) y se observa falta de iniciativa en la toma de turnos durante la interacción. Los resultados apuntan a la necesidad de desarrollar una mejor implementación de las técnicas de elicitación narrativa por parte del interlocutor, teniendo en cuenta, además, las limitaciones intrínsecas de los SAAC.

## Palavras-chave

comunicación aumentativa y alternativa; parálisis cerebral; educación especial; producción de lenguaje; construcción narrativa

## Introduction

Children with cerebral palsy (CP) have difficulties in language acquisition and development, which in turn hampers their social and educational inclusion. One way to overcome these difficulties is using augmentative and alternative communication systems (AACs). The term *augmentative* refers to instruments that supplement speech when it is not intelligible, while *alternative* alludes to the fact that these systems are intended to be used by individuals whose spontaneous production is compromised. While the advantages and shortcomings of these systems have been studied in various communicative contexts (Pino, 2014; Viera & Reali, 2020), the characteristics of the narrative production of children users of AACs have not yet been fully understood. This research presents a case study aiming to understand the role played by assisted communication in the narrative production of children with CP in the classroom, in the context of Uruguay's special public education.

It is essential that children with CP have the appropriate tools to meet the challenge of narrative production as part of their linguistic competence. Narrative discourse emerges naturally in humans, well before entering school. According to constructivist approaches (see Bruner, 2004; Vygotsky, 1978), the use of narrative language is a conceptualization tool that fosters cognitive development at various complexity levels (Petersen et al., 2008). Bruner (2004) posits that the use of the narrative mode is a fundamental way to understand reality. This is especially relevant in children with CP due to the language production disability it entails. Besides their importance vis-à-vis conceptualization, narrative skills are key to the development of social cognition, since they entail the child's ability to understand how a story's characters and events relate to each other, providing an intersubjective framework for comprehension. In this line, many authors have emphasized that the kind of intersubjectivity catalyzed by narrative construction is fundamental for the learning processes that take place in the classroom (Matusov, 2001; Talamo & Farsulo, 2022). For example, it has been shown that the use of narratives at school nurtures complex thinking and metalinguistic competencies (Ligorio et al., 2005).

Children with CP face daunting challenges in language development, both in terms of speech-related motor functions (Puyuelo, 2001) and language production at different levels (phonetic-phonological, morphosyntactic, lexical, and pragmatic), all of which are compromised in different ways in each case. In particular, children with CP have been found to exhibit a delay in the acquisition of the phonological repertoire (Moreno et al., 2004), a tendency to produce shorter and less syntactically complex utterances, and a reduced vocabulary (Puyuelo, 2001; Moreno et al.,

2004). In addition, pragmatic aspects of language are often challenged as well: difficulties to initiate conversation have been observed, which limits linguistic insertion in various social situations.

These difficulties have long-term consequences. For instance, Puyuelo (2001) has observed that children with CP show developmental delays due to what has been called *use deficit*. In line with usage-based constructionist theories, it has been suggested that limited language use during development has consequences beyond motor failure related to articulation. Language production is fundamental for the acquisition of other aspects of linguistic and cognitive ability, including comprehension and conceptualization (Bruner, 2004). In this regard, limitations in production have shown to have a negative impact on grammatical knowledge (Sutton et al., 2000), as well as on pragmatic and social aspects of language use (Ketelaars et al., 2016).

In short, because of their linguistic production challenges, children with CP face an enormous disadvantage in access to, and permanence in, the education system. In Uruguay, the population with disabilities attending an educational institution is almost 4 % lower than the population without disabilities. The discrepancy between these populations grows with increasing levels of education, reaching 6.2 percentage points for the 12-17 yearsold age group (Instituto Nacional de Estadística [INE], 2011). Thus, it is fundamental to boost the development of strategies that may promote the educational inclusion of these children and young people. While, as noted before, AACs can aid in mitigating the limitations in language production of children with CP (Basil et al., 2012; Pino, 2014), their effectiveness in fostering the narrative mode is not fully understood. Insofar as classroom inclusion of this population depends to a large extent on the use of these systems, it is necessary to establish their advantages and shortcomings, not only in terms of communicative achievement but also in their capacity to make possible the full development of children's linguistic abilities and thus boost complex narrative production.

A subject's insertion in their social environment requires the development of systems that boost not only the ability to produce simple sentences or concepts for immediate communication but also the skill to construct narratives and achieve free expression in diverse circumstances. Studies have shown that the use of AACs in children with CP involves several problems. For example, the applications available in the market have not been especially designed to assist users with CP, which means that they are not appropriate for users with compromised motor abilities (see the recent revision of Viera & Reali, 2020). Additionally, some of the functionalities offered by these applications are not appropriate to research psycholinguistic aspects. The reason behind this is that existing AACs have been designed for immediate communication and are not necessarily oriented

toward maximizing complex language production or creative narrative construction. Therefore, it is important to explore the language produced by children users of AACs in terms of lexical features and semantic complexity, as well as the conditions that foster these children's linguistic production through the use of these devices.

In previous studies, Viera and collaborators (Moreira et al., 2012; Viera, 2012) have analyzed the use of AACs in the training of special education teachers in Uruguay, with the aim of promoting the appropriation of cultural tools and thus enhancing children's learning in the context of non-assessment participatory activities. Another study by Viera et al., (2014) researched in greater depth the role of the instrumental mediation of AACs in the assessment of the potential psychological development of children with motor disabilities and without oral language. This study revealed a number of positive aspects of pictogram-based AACs use in language and communication tasks in children with CP, even in the case of those with very little previous knowledge of these systems. Nevertheless, the study also showed that children encountered difficulties in integrating concepts and elements in their own communicators and that, while they did use the pictograms offered within the context of activity planning to respond to specific questions, they showed no signs of a spontaneous or productive use of the pictograms.

The current study was motivated by the prior research mentioned above and aims to conduct a comprehensive analysis of AACs use in the classroom, as well as of the role of these systems in these children's linguistic productivity during narrative construction in social interaction contexts. One of the objectives is to evaluate the scaffolding strategies used by teachers to elicit communication from children with CP. These strategies are used by adults to boost the linguistic production of children whose speech is compromised, in an effort to foster metalanguage, inference and interpretation (Liboiron & Soto, 2006; Rogoff, 1990). Scaffolding strategies include the use of sensitive, flexible and creative elicitation questions and techniques geared towards the child's gradual acquisition of autonomy in his or her narrative production. Since it involves joint participation and turn-taking, shared reading provides an ideal context to implement these strategies. The literature has shown the use of scaffolding strategies during shared reading sessions to be effective in enhancing linguistic production and comprehension in children with language impairment (Bellon & Ogletree, 2000; Crowe et al., 2000), especially when the adult has been trained in shared story reading (Liboiron & Soto, 2006).

This research took place in a special public school attended by children with CP in Montevideo, Uruguay, in a context of AACs-assisted narrative co-construction. Three children, all of them AACs users, were selected to participate in the story reading sessions. Three shared reading sessions

were conducted, with the adult interlocutor using elicitation strategies to boost linguistic production. Three main aspects of child-interlocutor interaction were studied: a) the features of the children's language in terms of grammar, as well as the semantic complexity of the meanings produced; b) the strategies used by teachers (open-ended or closed-ended questions) to boost language production in the children; and c) how the AACs systems used by the children aided or hindered linguistic production.

## Methodology

The situated research conducted was qualitative in nature. Three cases of children AACs users were studied, with the aim to explore their narrative skills in an interaction context during an adult-child story reading session. The language of each child was observed and transcribed for analysis.

The research took place in the only public educational institution for children and young people with motor disabilities existing in Uruguay (Escuela Dr. Ricardo Caritat), between October 2016 and December 2017.

## Participants

### Children

Three children (Fausto, Rocío and Tatiana<sup>1</sup>) were chosen for this study. The selection criterion was that they must be students with CP users of AACs. It was considered relevant that they should have their own communicator or booklet<sup>2</sup> in order to ensure that they were familiar with its use.

Fausto was 10 years old and was in second grade of primary school; Rocío and Tatiana were 14 years old and were in sixth grade. Rocío was integrated to a regular school, but split her time between attending the regular school and a special school. All three children had been diagnosed with CP, but the severity of motor impairment and the levels of dysarthria were different for each of them. Fausto and Tatiana had greater motor and speech impairments. Motor impairment is relevant to characterization since it determines accessibility to the use of AACs. Table 1 shows a summary of the children's characteristics.

According to the psychological assessment of cognitive abilities (conducted via a progressive matrices test) and of receptive vocabulary (via a Peabody test), two of the children selected (Tatiana and Rocío) showed a

1 Pseudonyms have been used to preserve the anonymity of the subjects.

2 Typically, a child's own communicator is made with the help of a speech therapist or teacher so that the child can use it at home and at school.

typical discrepancy from the population mean for the same chronological age. Fausto was the only one of the three to be within the range expected for his age. Rocío's results placed her in the lower limit of the mean, and Tatiana had a performance considerably below the expectations for her chronological age.

**Table 1.**  
*Characteristics of the children*

Name	Fausto	Rocío	Tatiana
Sex	Male	Female	Female
Age	10	14	14
Motor dis-ability	Severe: He can only move his head, with difficulty.	Mild: She can move both hands.	Severe: She can only move her right hand, with difficulty.

*Source:* researchers' own data.

### Teachers

Tatiana's and Fausto's schoolteachers took part in the study. They differed in the length of their teaching careers and in the number of years they had been working in their particular schools. Fausto's had been a teacher for over thirty years, and had been teaching in her special school for fifteen years. Tatiana's had been a teacher for ten years, 6 of those spent in the special school.

Both teachers had specific training in special education for children with motor disabilities as well as in augmentative and alternative communication (AAC). This was partly due to the fact that the school's development plan and their own pedagogical aims include teacher training in AAC. In particular, an intervention and research had been conducted in 2017 focusing on the use of AACs in the school.

### Tools and materials

#### Measurement of the children's linguistic and cognitive abilities

*Peabody picture vocabulary test, ppvt-iii* (Dunn et al., 2006). This vocabulary test measures the level of receptive vocabulary, as well as linguistic and verbal cognitive potential. It has been used to assess children whose linguistic production is compromised.

*Progressive matrices test* (Raven et al., 2003). This test measures abilities related to a non-verbal intellectual quotient, including perceptual, observational, and analogical reasoning abilities.

## AACS used by the children

All three children used digital communicators regularly. Tatiana and Rocío used the Let me Talk system, a free-distribution, closed-code system for Android (version 4.0.3 or above), and Fausto used Plaphoons, a free-distribution, open-code software for Windows or Linux. All three children worked with the ArAsAAc pictogram communication system.

Tatiana and Fausto also used ad-hoc designed boards and communication books. Tatiana's communication book was based on the picture communication system [PCS] (Mayer-Johnson, 1986).

## Shared reading sessions

Preparatory activities were conducted with the teachers and children in order to design the shared reading sessions. The teachers were consulted in the selection of the story to be used as well as in the preparation of materials such as pictogram boards and the children's digital communicators.

*Story.* The story "Rapigato and Ratontuelo become friends" ("De cómo Rapigato y Ratontuelo se hicieron amigos") (Sione, s. f.) was used for the shared reading session. This story was already being used in the current curricular activities of the school, so the children were familiar with it. It is 606 words long, on two pages without illustrations. The author is a 13-year-old female teenager.

## Procedure

Once the children were selected, and after their parents had signed their informed consent forms and the children had given their own consent, the receptive vocabulary and intelligence tests were put forward.

During April and June 2017, interviews to teachers were conducted, with an average duration of one hour. All interviews were recorded and carefully transcribed, following Jeffersonian Transcription Conventions (Jefferson, 1985).

Shared reading sessions took place in the school premises. All instances were video recorded with two cameras—one for a general shot of the interaction situation (the shared reading session) and another for a close-up recording the child's use of AACS.

The language produced by the adult and the child was transcribed using an expanded transcription system (Liboiron & Soto, 2006), taking into account augmented interactions such as gestures, facial expressions and vocalizations, as well as the material produced via the AACS and verbal productions. Transcriptions were carried out by the researchers' assistants and supervised by the lead researcher of this study in order to ensure reliability.



## Analysis

### Narrative elicitation coding criteria

During the shared reading session, narrative elicitation coding criteria were used considering previously documented scaffolding strategies. In particular, the criteria defined by Liboiron and Soto (2006) to categorize elicitation techniques were followed.

*Elicitation questions.* Each question posed by the adult was coded as “open-ended” or “closed-ended”. Open-ended questions were further classified as either constitutive questions (Cons. q.), with low semantic complexity, or comprehension questions (Comp. q.), with high semantic complexity.

Besides questions, other narrative elicitation strategies were used, as shown in Table 2.

**Table 2.**

*Narrative elicitation techniques*

Strategy type	Strategy description
Written reference (WR)	The adult points at information printed on the book.
Completion procedure (CP)	The adult starts a sentence and waits for the child to complete it.
Expansion (Ex)	The adult repeats the child's utterance including a syntactically correct construction.
Binary option (BO)	The adult offers two possible sentences or icons for the child to choose.
Pointing, gesturing or verbalizing (PGV)	The adult points at information printed on the book, including a suggestion or verbal cue.

*Source:* researchers' own data.

### Analysis categories and dimensions for interaction coding

*Communication mode.* Children's AACs use (vs non-use) was recorded, as well as how this was alternated or supplemented with other communication modes such as gestures, pointing, expression and vocalizations.

*AACs-mediated communication.* In the description of AACs-mediated communication and language, several analysis categories were taken into account, based on the psycholinguistic measurements described below.

In order to study the morphosyntactic complexity that communicators allow children to produce, the methodology of mean length utterance (MLU) (Brown, 1973) was used. This was measured in words per sentence. The class or type of each phrase or sentence was also studied, as well as the function or grammatical modality of the utterance.

Lexical diversity was studied by measuring word class or word type. This kind of analysis establishes a distinction between lexical units and grammatical units. Lexical words are informative items which designate objects in the world, actions, properties, processes, or states; and grammatical words are the devices that join them and provide them with a structure (Cuetos et al., 2018).

*Active vocabulary* is the vocabulary that the child usually employs in a productive way. Besides the vocabulary produced through speech, pictogram groups in communication books and digital communicators are also considered to be part of active vocabulary. This is distinguished from passive or receptive vocabulary, estimated via the ppvt-iii.

In order to ensure the reliability of the procedure, the data was codified and analyzed independently by another person trained in transcription, besides the main author of this study. Due to the simplicity of the children's linguistic production, there was no significant ambiguity in the coding of psycholinguistic measurements such as MLU and word type. In the case of the coding of the scaffolding strategies used in the reading sessions, there was an initial agreement between assessors of 81.1 %.

The cases in which there was no agreement were solved by consensus.

## Results

### Session duration and turn-taking

Table 3 shows the duration and turn-taking observed in the shared reading sessions with the three children. In all cases a shared reading session was carried out, although duration varied according to each child's characteristics.

Fausto's session lasted for 45 minutes and 43 seconds and there were 171 turns, almost half of which (76) belonged to the child. Rocío's session had a duration of 29 minutes and 4 seconds, with 256 turns, 126 of which belonged to the child. Lastly, Tatiana's session was the shortest, at 15 minutes and 28 seconds, and the child took 55 turns out of a total 126.

**Table 3.**  
*Description of the shared reading sessions*

Child	Total number of turns	Duration	Child's turns	Duration	Adult's turns	CT/TT ratio	Duration
Fausto	171	45:43	76 (44.3 %)	19:50	95 (55.5 %)	0,8	25:53
Rocío	253	29:04	126 (49.8 %)	12:39	127 (50.1 %)	0,99	16:25
Tatiana	126	15:28	55 (43.6 %)	4:00	71 (56.3 %)	0,77	11:28

Note: CT = child's turns; TT = teacher's turns.

Source: researchers' own data.

## Communication mode

In these results, the effects of the severity of the participants' motor disability on their communication abilities is studied, as well as their command of AACs use. Table 4 shows frequency of AACs use for each participant.

**Table 4.**  
*Communication mode in shared reading sessions*

Child	Pointing (% of use)	Gesture (% of use)	Voice (% of use)	AACS (% of use)
Fausto	2 (3 %)	2 (3 %)	1 (1.5 %)	60 (92.5 %)
Rocío	0	4 (4 %)	50 (50.5 %)	45 (45.4 %)
Tatiana	5 (12.8 %)	19 (48.7 %)	1 (2.5 %)	14 (35.8 %)

*Source:* researchers' own data.

In all three cases, AACs use was well-represented. According to frequency analysis, Fausto was the child with the highest use (92.5 %), followed by Rocío (45.4 %) and Tatiana (35.8 %). Besides, Fausto, unlike the other two participants, used AACs more than other communication modes/types.

It was again Fausto who used AACs with the most effectiveness, with only one failed response attempt, as opposed to Rocío's 4 and Tatiana's 3. However, Fausto was the participant who needed the most steps to achieve communication (between two and four steps). In this regard, it is worth noting that out of the 60 instances of AACs use mentioned, only 43 (72 %) had the aim of communicating. The remaining 18 instances (28 %) were used to execute communicator options linking to sequences directed towards different fields sharing a semantic or lexical criterion (pictogram groups associated with a context of use)—for example, the categories connected with the story used in the elicitation activity: *characters*, *actions*, *other*. In the case of the Let me Talk device, some limitations in the production of utterances above one word in length were observed, as well as a difficulty to establish links between fields to allow the selection of several units.

On the other hand, Plaphoons presented some dysfunctional aspects, such as an effort overload when navigating between fields, and limitations regarding the child's possibility to combine and select lexical units. It should be noted that this communicator offers phrases or sentences that can be selected, which entails a limitation to the child's (linguistic) productive alternatives (as well as a restriction in difficulties).

## Lexico-grammatical complexity of linguistic production

In order to analyze the lexico-grammatical complexity of the children's verbal production, the following indices were used: mean length of utterance (MLU) measured in number of words, word class or word type, class or type of phrase/sentence, and function or grammatical modality of the utterance.

Grammatical complexity was estimated via the MLU. Table 5 shows the results.

**Table 5.**  
*Mean length of utterance in shared reading sessions*

Child	Total number of utterances	Average MLU	One word	Two words	Three or more words
Fausto	43	1.16	38 (88.3 %)	3 (6.9 %)	2 (4.6 %)
Rocío	97	1.17	82 (84.5 %)	13 (13.4 %)	2 (2 %)
Tatiana	28	1	28 (100 %)	0	0

*Source:* researchers' own data.

Rocío was the participant who produced the most utterances (97), followed by Fausto (43) and Tatiana (31). In all cases, most utterances were one word in length, which shows their low level of complexity. Average MLU was below 2 in all cases. Rocío achieved the highest average (1.17), followed by Fausto (1.16) and Tatiana (1). It is worth noting that Tatiana was the only participant to use AACs to produce the polarity adverbs *sí* (yes) and *no* (no), which constitute full sentences. On the other hand, Fausto's communicator (Plaphoons) provided several pre-established sentences. This construction of pre-established phrases in the communicator is reminiscent of the concept of *listeme* (Pinker, 1995), different from *word*, since it refers to an element or unit memorized as part of a list called the *lexicon*, rather than generated by a rule. In this regard, each of these pre-constructed phrases or sentences could be considered a word. In this research, these pre-constructed phrases or sentences were considered to derail the analysis of MLU computation. It is nevertheless worth noting that the communicator used by Rocío y Tatiana (Let me Talk) provided the possibility to edit lexical units so as to match a pictogram with a phrase or sentence. The frequency with which this type of element was used was probably affected by the fact that Fausto needed a computer and a peripheral device to execute his digital communicator, resulting in a more complicated use and, consequently, a slower exchange in communication. Rocío and Tatiana, on the other hand, had a less restricted mobility and used their cellphones to this end.

## Characteristics of the produced lexicon

In this section, the class or type of word, phrase or sentence produced by the children through the AACs will be analyzed. In all cases, lexical words, especially nouns, were predominant, and functional words, such as prepositions, articles, pronouns and others were almost never used. The children's communicators did not have words of this kind, although AACs makes room for them. This means that the child must search the word in question on the Internet through his or her communicator. For Fausto, this action was impossible since he was using a closed device.

As can be seen in Table 6, in two of the cases, nouns accounted for more than half of the total number of words uttered by the child.

**Table 6.**  
*Type of word in shared reading sessions*

Child	Nouns	Verbs	Adjectives	Functional words	Yes, No	Total
Fausto	32 (57.1 %)	12 (21.4 %)	8 (14.2 %)	1 (1.7 %)	3 (5.3 %)	56
Rocío	40 (47.6 %)	19 (22.6 %)	18 (21.4 %)	7 (8.3 %)	0	84
Tatiana	5 (17.8 %)	1 (3.5 %)	6 (21.4 %)	0	16 (57.1 %)	28
Total	77 (45.8 %)	32 (19 %)	32 (19 %)	8 (4.7 %)	19 (11.3 %)	168

Note: percentages correspond to each child's use.

Source: researchers' own data.

Table 6 shows the predominance of nouns (77) (45.8 %) over other word categories. Adjectives (31) (19 %) and verbs (31) (19 %) were in second place, followed by functional, lexically empty words, such as articles or prepositions (8) (4.7 %), with the adverbs *yes* and *no* occupying the last place.

Most of these nouns are proper nouns, namely the names of the characters in the story: Rapigato, Gatontuelo, Gatolicía, Gatomisario. There are also common nouns, such as *vigilantes* (*guards*).

In all cases, nouns amounted to full statements, since they were answers to questions asked during the shared reading of the story. That is to say that in the context of production of these statements, common nouns acquired a referential function.

## Scaffolding strategies used by the teachers

Table 7 shows the number of occurrences of the various scaffolding strategies used in the shared reading sessions. Tatiana's and Fausto's sessions were conducted by their respective teachers, whereas Rocío's session was conducted by a research assistant.

**Table 7.**

*Scaffolding strategies used in the reading sessions*

Child	Cons. q.	Comp. q.	Closed- ended q.	WR	PGV	BO	CP	Ex	Total
Fausto	30 (30 %)	14 (14 %)	8 (8 %)	2 (2 %)	2 (2 %)	3 (3 %)	8 (8 %)	33 (33 %)	100
Tatiana	15 (20.2 %)	9 (12.1 %)	38 (51.3 %)	1 (1.3 %)	0	2 (2.7 %)	0	9 (12.1 %)	74
Rocío	32 (28.5 %)	22 (19.6 %)	16 (14.2 %)	11 (9.8 %)	0	0	18 (16 %)	13 (11.6 %)	112
Total	77 (26.9 %)	45 (15.7 %)	62 (21.6 %)	14 (4.8 %)	2 (0.6 %)	5 (1.7 %)	26 (9 %)	55 (19.2 %)	286

Legend: WR = written reference; PGV = pointing, gesturing or verbalizing; BO = binary option; CP = completion procedure; Ex = expansion. Percentages correspond to each child's use.

Source: researchers' own data.

Among the total number of occurrences, the use of constitutive questions as a narrative elicitation technique stands out (77; 26.9 %), followed by closed-ended questions (62; 21.6 %), expansion (55; 19.2 %), and comprehension questions (45; 15.7 %).

Rocío's session showed the highest number of occurrences overall, followed by Fausto's session, and finally Tatiana's. Nevertheless, it is worth noting that the three sessions had different durations, which had an impact on these figures.

Different techniques were more or less used, depending on the case. In Fausto's and Rocío's sessions, constitutive questions were one of the most used, at 30 (that is, 30 % of the total number) and 32 (28.5 %) respectively, whereas in Tatiana's sessions the use of this technique, with 15 occurrences (accounting for 20.2 % of the total), was well below the use of closed-ended questions, at 38 occurrences (51.3 %).

Expansion was the prevalent technique in Fausto's session, with 33 occurrences (33 %). It was less used in Rocío's session (13; 11.6 %), and even less with Tatiana (9; 12.1 %). Below is an example of a constitutive question and expansion in Fausto's session:

Adult: What are the story's characters called? [...] There were two that we know, they are where the characters are. Let's see if you find them. In fact, there are four that we know ((reinforces the number of characters by showing four fingers, at the same time pointing at the child's communicator)), two that are not so important ((explains)). So return to the characters.

Child: Communicator %return% (19), ((waits for the mouse to follow the sequence until the category is reached)) %CHARACTERS%

Adult: Very good. So, who do you have over there?

Child: (10) ► Communicator %Rapigato% ((smiles upon the teacher's "approval" of the answer)).

Adult: Rapigato (1) ((uses her fingers to count the characters who are guards one by one - 1)).

Child: (4) ► Communicator %Gatolicía%, ((smiles upon the teacher's "approval" of the answer)).

Adult: Gatolicía ((uses her fingers to count the characters who are guards one by one - 2)).

Child: (26) ► Communicator %Gatontuelo%, ((smiles upon the teacher's "approval" of the answer)).

Adult: Very good, Gatolicía (2) ((lays her hand on the mouse button without brushing against the eye, guard characters - 3)).

Child: ► Communicator %Gatomisario%, ((smiles upon the teacher's "approval" of the answer)).

Adult: Very good, let's keep those four characters ((uses her fingers to indicate that the counting of the 4 characters has finished)).

As can be seen from the example, these elicitation strategies tend to appear together. The expansion strategy leads the child towards the search for an answer in his or her own communicator. This activity has already been done with the teacher before, so the story has been organized in semantic fields within the digital communicator: *characters, actions, other*. These semantic fields anticipate some of the teacher's questions.

Comprehension questions were frequently used in Rocío's session (22 occurrences), but less so in Fausto's (14) and Tatiana's (9). Below is a segment showing an occurrence of this type of question in Rocío's session.

Adult: It- It showed you there- Slow, good. It was slow (referring to the digital communicator). How did the cats feel when the mice left Gatonesa City? So ... [...] And how would we search if there was a different word there? Besides getting how? ((points at the **happy-moved** pictogram in the communication board)).

Child: ACTIONS, %LAUGH%

Adult: Laugh. But, besides laughing, how did they feel?

Child: ((Keeps searching in the communicator, gets out of ACTIONS and gets into ACTIONS again)) %LAUGH%

In this case, the point was a reference to a feature of the characters that the child had to infer or construe, but which was not explicitly stated in the story. This made it more difficult to rely on the communication board offered for production by the research team, which led to the interlocutor's intervention by using a written reference strategy.

Closed-ended questions were very relevant in Tatiana's session (38), but they were a much less frequent resource in Rocío's (16) and Fausto's (8). What follows is an example from Tatiana's session:

Adult: What animals appear in the story? (5) [...] Sure, because you, very good! There are two cats ((points with her pinkie at the cats that the child has selected)), they were... that I am not going to tell you the names. There were two cats the main characters yes ((uses her hand to indicate 2, i.e. the number of cats)), which you are putting here for me ((points at the communicator's screen)). Good, is it just cats that appear?

Child: ↓▼%MOUSE% ((a few pictograms too many slip out %Cheese%, %Cheese%)) (laughs) (6).

Adult: Does the cheese appear?

Child: ↑▶←→ ((Shakes her head to indicate NO)) (1).

In this example, it can be seen that the strategy of using a closed-ended question is often preceded by a constitutive question. However, in the absence of a response, the teacher finishes by asking a closed-ended question.

The following segment is an example of how these different strategies may appear together in the same intervention by the teacher.

Let's see now if you find, for example, something that shows that he thought he was superior to the rest. (17) I will be doing the scanning as we go. We'll start at this second ((points at the second row in Fausto's communicator)). This is, they don't like each other at all ((**enemies** pictogram)) this is slow, like a snake ((points at the **slow** pictogram)), this is foolish ((points at the **foolish** pictogram)), and this? ((points at the **Superhero** pictogram)), Superhero, eh? ((looks at Fausto, waiting for a response)). Do you feel this is an appropriate word for how Rapigato was feeling? What do you think? (6).

In this example, several strategies appear in succession: a comprehension question, a closed-ended question, an expansion, and a written reference.



## Discussion

The information obtained through the devices and techniques used in this research has resulted in the establishment of a detailed profile of the children's linguistic production in a shared reading context.

The levels of cognitive, motor, and linguistic impairment varied in each case. In the psychological evaluation and receptive vocabulary assessment, the selected children's performance was found to differ greatly from the population mean for the same chronological age. In connection with this, Fausto was the only participant to be within the range expected according to age. Rocío's results placed her in the lower limit of the mean and Tatiana's performance was considerably below the expectations for her chronological age. It is worth noting at this point that there is a match between our sample and the description of this population provided by the literature (Stadskleiv, 2020).

The results of shared reading sessions revealed some important aspects of AACs use, of the linguistic features of the participant children's production, and of the strategies used by the adult interlocutor for narrative elicitation. In all three cases, the vocabulary produced by the children was very limited, and the phrases constructed were simple and extremely short. This is consistent with previous results that show that, although AACs users often have the ability to understand a wide range of grammatical structures, they can have considerable limitations in their production, both grammatical (Binger & Light, 2008) and lexical (Clendon & Erickson, 2008), notwithstanding the fact that this may vary greatly from one individual to another. The difficulties observed may be partly due to the features of AACs, since while it has been found that these systems make it possible to organize specific semantic items (nouns and action verbs), organizing and accessing more abstract items (such as grammatical markers) is more demanding, which leads to difficulties in producing complex grammatical constructions (Fallon et al., 2003). Difficulties in access to lexical and grammatical construction, in turn, has a negative impact on long-term development. Over the last two decades, studies on AACs use have shown that when speech is seriously compromised, the use of graphic symbols poses challenges which may have important consequences on syntax and morphology acquisition (Sutton et al., 2002).

It was also observed that it was adults that initiated turns during conversation. This is consistent with the findings of Clarke and Kirton (2003), who carried out conversation analysis in pairs of children with CP who were AACs users and their speaking peers. They found that the former produced a significantly smaller number of initiating turns than the latter.

In all cases, the main purpose of the scaffolding strategies deployed by adults seemed to be that of maintaining the child's participation in the conversation, which showed limited planning during the generation of utterances. The strategies that were most used to elicit narrative language from children were mainly based on simple or closed-ended questions that led to short answers with low semantic complexity.

The development of conversations was dialectical, since participants used their turns to respond to the previous contribution of their interlocutors. As can be seen from the selected segments, expansion of the child's expression turned out to be one of the most interesting strategies.

Language features and the tendency to take initiative were found to vary from child to child, regardless of literacy level. Participant children's intrinsic motivation to produce complex language may have been linked to parental habits or other factors.

## Conclusion

This case study illustrates two types of difficulties concerning language development in children with assisted communication: (1) limitations in the augmentative and alternative communication systems used by the children, and (2) limitations in the narrative elicitation strategies used to foster productivity, even in the case of teachers with considerable experience in working with this type of population.

These results reveal the need to advance effective actions aiming to nurture narrative language productivity in children with cerebral palsy (CP). There are two important fronts. On the one hand, there is a need to design *augmentative and alternative communication systems* (AACs) which are appropriate not only for immediate communication but also for the production of complex language. Several studies have alerted that these systems show intrinsic limitations when it comes to fostering narrative production beyond immediate communication (Light et al., 2019; Sutton et al., 2020; Viera & Reali, 2020). On the other hand, it is necessary to develop a better implementation of narrative elicitation techniques and strategies in order to foster interaction, as well as the child's initiative, in intersubjective learning contexts.

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