

Application of Augmentative and Alternative Communication to stimulate communicative intention and cognition in patients with Autism Spectrum Disorder

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A study conducted at Instituto Priorit, Rio de Janeiro, Rio de Janeiro, Brazil, and at Universidade Federal Fluminense, in the Vocational Master's Program in Diversity and Inclusion, Niterói, Rio de Janeiro, Brazil.

Financial support: This study was financed in part by the Fundação de Amparo à Pesquisa Carlos Chagas Filho do Estado do Rio de Janeiro (FAPERJ), Protocol number E-26/211.069/2019 (DNC).

Conflict of interests: Nonexistent.

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Received on: July 5, 2023

Accepted on: September 5, 2023

ABSTRACT

Purpose: to assess the advancement in communicative intention and cognition in children with autism spectrum disorder after applying a personalized alternative communication method.

Methods: patients had their communicative intention and cognition (Vineland-3) assessed before and after the intervention with 10 structured alternative communication sessions. The “Demystifying Alternative Communication” podcast was developed as supplementary material to this study. Student’s t-test was used, setting the significance level at $p < 0.05$.

Results: patients improved their communicative intention, with higher scores after the intervention, and no changes were found in relation to cognition.

Conclusion: even though the patients’ equivalent age was inferior to their real age in the communication subdomain assessment, they progressed in expressive communication, language, and writing.

Keywords: Autism Spectrum Disorder; Child Language; Cognition; Social Cognition; Speech, Language and Hearing Sciences



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INTRODUCTION

The Diagnostic and Statistical Manual of Mental Disorders defines autism spectrum disorder (ASD) as a neurological developmental disorder, characterized by communication and social interaction difficulties and repetitive or restricted behaviors and/or interests¹. American studies indicate a 1:44 prevalence of ASD among 8-year-old children². Worldwide, this prevalence is about 1%³. ASD symptoms and manifestations are greatly heterogeneous, involving cognitive, emotional, motor, social, and communication areas⁴.

Communication and language deficits are among the main characteristics of ASD, present in approximately 63% of these patients⁵. Communication is one of the main competencies necessary to every human, and its absence or difficulties can importantly impair their social, relational, and formal learning aspects.

The language construction process is directly related to the cognitive skills. Classic models of language acquisition assume that children already have consolidated basic world representation concepts. Thus, language acquisition includes the mapping of speech stimuli received in this set of concepts. Human cognition differs from that of other species by its connection with language^{6,7}.

The establishment of functional communication directly impacts overall development and quality of life, enabling autonomy and freedom of choice and expression. It can also ensure greater quality in education, contributing to cognitive development, inclusion in the school setting, and improved family relationships⁷.

Tools such as augmentative and alternative communication (AAC) promote functional communication⁸. According to the American Speech-Language-Hearing Association (ASHA), AAC aims to compensate and facilitate either permanently or not the impairments and disabilities of patients with severe expressive (gestural, spoken, and/or written) comprehension and communication disorders. Introducing it early in child development not only does not limit the production of speech acquisition but also helps organize it, in which the family's active participation is essential to a successful therapy^{9,10}. AAC comprises assistive technology – i.e., it is a tool specifically intended to broaden communication skills. Over time, adjustments were made to this tool, with cards, symbols, photographs, drawings, and handbooks for better comprehension¹¹. Its construction is made by associating these resources with writing or other technologies, such as software¹².

The acquisition of communicative competence is influenced not only by linguistic, operational, social, and strategic competencies but also by a variety of psychosocial factors (e.g., motivation, attitude, confidence, resilience) and environmental barriers and support¹³. Establishing conventional forms of communication poses a challenge to these individuals, as areas of lexical, grammatical, or cognitive comprehension are not always impaired. On the other hand, difficulties in using social communication importantly impair and may compromise the development of language processes and, consequently, that of cognition, behavior, and sensory aspects¹⁴. Moreover, the myths and lack of information related to alternative communication (AC) can often hinder its introduction and use.

This study aimed to analyze the advancement of communicative intention and cognition in children with ASD with the application of a personalized method – Personalized Alternative Communication (PAC).

METHODS

Research location and sample

This research was approved by the Ethics Committee of the Universidade Federal Fluminense, Brazil, under evaluation report number 34637420.7.0000.5626 (CAAE).

It included participants of both sexes diagnosed with ASD. They were recruited at the institution of origin and had been undergoing speech-language-hearing therapy for at least 6 months, with no interruptions and a 90% attendance. The study did not include participants who could not perform the sessions with the AC method due to cognitive or physical disability. All participants were authorized by their parents/guardians, who filled out and signed an informed consent form.

Initial and final assessments

The initial and final assessments, for comparison, had a structured interview with the participants' parents/guardians, a specific questionnaire to assess communicative intention (Chart 1), and the Vineland Adaptive Scale-3 – communication domain, applied by a psychologist. The participants' information was surveyed in the initial data collection, including already familiar vocabulary repertoire related to objects, people, and places to be used in PAC application stages.

Chart 1. Communicative intention assessment questionnaire

This questionnaire had 19 questions, organized into comprehensive (1 – 8) and expressive aspects (9 – 17) and both (18 and 19). The score ranges from 19 to 84 – higher scores indicate greater communicative intention difficulties.

- (1) **Initial perception of the environment and engagement:** (1) Notices the presence of the parent/guardian; (2) Does not notice the presence of the parent/guardian.
- (2) **Eye contact:** (1) Makes eye contact; (2) Makes occasional eye contact; (3) Does not make eye contact.
- (3) **Gesture imitation:** (1) Imitates gesture models; (2) Does not imitate.
- (4) **Comprehensive language:** (1) Responds when called by name; (2) Responds to requests; (3) Partially responds to requests; (4) Reacts to sound stimuli; (5) Does not respond to requests; (6) Does not respond to sound stimuli.
- (5) **Comprehension of intonation changes:** (1) Understands prosody changes; (2) Partially understands prosody changes; (3) Does not understand prosody changes.
- (6) **Social Language:** (1) Uses social language; (2) Partially uses social language; (3) Does not use social language.
- (7) **Reading:** (1) Reads; (2) Partially reads; (3) Does not read.
- (8) **Verbal Comprehension:** (1) Understands orders with three or more actions, requests, or comments; (2) Understands two unrelated orders; (3) Understands situational orders with one action, not accompanied by gestures; (4) Understands situational orders with one action, accompanied by gestures; (5) Responds when called by name; (6) Responds not systematically to a request, accompanied by gestures; (7) Does not respond to language.
- (9) **Expressive language:** (1) Verbal; (2) Communicative skill; (3) Partially uses expressive language; (4) Uses expressive language; (5) Uses unintelligible sounds; (6) Does not use expressive language.
- (10) **Communicative intention:** (1) Begins communication; (2) Responds to the interlocutor; (3) Has low communicative intention; (4) Has communicative intention with inadequate resources; (5) Does not have any communicative intention.
- (11) **Gestural language:** (1) Uses gestural language; (2) Partially uses gestural language; (3) Does not use gestural language.
- (12) **Communicative functions:** (1) Interactive; (2) Informative; (3) Naming; (4) Narrative; (5) Protest; (6) Instrumental.
- (13) **Means of Communication:** (1) Words; (2) Gestures; (3) Vocalizations.
- (14) **Echolalia:** (1) Does not use echolalia; (2) Partially uses echolalia; (3) Uses echolalia.
- (15) **Written language:** (1) Uses written language; (2) Partially uses written language; (3) Does not use written language.
- (16) **Language contextualization:** (1) The language goes beyond the immediate situation, referring to more distant events; (2) The language describes the action that is taking place and does not go beyond the immediate context; (3) The language refers only to the immediate concrete situation.
- (17) **Imitation/symbolic play:** (1) Uses verbal language to report what is happening in the play situation; (2) Develops symbolic play; (3) Organizes symbolic sequences; (4) Uses dolls or action figures; (5) Does not use symbolic behavior.
- (18) **Level of toy organization:** (1) Sorts toys according to their differences, following criteria; (2) Sorts objects by trial and error; (3) Groups toys in categories; (4) Puts objects in a row; (5) Makes little groups; (6) Handles toys in a disorganized way.
- (19) **Cognitive aspects:** (1) Explores objects one by one in a diversified way; (2) Handles two or more objects repetitively and simultaneously, relating them; (3) Persists in the activity when obstacles appear, trying to overcome them; (4) Explores objects one by one, repetitively; (5) Gives up when an obstacle appears; (6) Is not interested in objects.

Application of the Personalized Alternative Communication (PAC)

The speech-language-hearing team ($n = 3$) was trained to standardize the techniques. They also gave feedback to this study's lead researcher after each session.

The PAC method was constructed to facilitate the creation of communication boards and ensure greater adherence of patients and parents/guardians. This low-technology option effectively broadens the patient's functional communication, gradually increasing their

communication repertoire. The forms used in all phases were made from laminated card stock (20 x 15 cm) with Velcro tape (13 x 2.5 cm) and bound as a notebook. PAC application was divided into four phases (Table 1), with a gradual construction in each one, according to each patient's initial level and acceptance. Phase 1, for instance, includes a single figure and the therapist's support. Gradually, phase 2 includes more cards, and the patient is stimulated to make choices with greater autonomy. Phases 3 and 4, with increased independence and less support from the therapist, encourage the patient's development and use of autonomy.

Table 1. Personalized Alternative Communication application phases

Phase	Description	PAC notebook	Session record
1	<p>A single figure is shown. The therapist stimulates the patient to remove the image from the notebook sheet, assisting them at the same time if necessary for the action to be complete.</p> <p>The therapist must support the patient in this phase so they can understand what they need to do; the support is gradually removed. The patient only advances to the next phase when they manage to hand the card to the therapist autonomously.</p>	<p>Only one communication card is included in the notebook. The communication cards measure 4.0 x 4.0 cm.</p>	<p>The patient must be able to remove the figure from the communication notebook sheet and hand it to the therapist.</p> <p>(1) The patient was able to remove the figure from the notebook sheet and hand it to the therapist with their support. (2) The patient was able to remove the figure from the notebook sheet and hand it to the therapist independently. (3) The patient was unable to remove the figure.</p>
2	<p>Two cards are included in the notebook. The therapist chooses the figures on the cards (based on the patient's interest). At this moment, the patient is free to choose which card will be used.</p> <p>The number of cards in this phase may progress to six.</p>	<p>2 to 6 cards are used. The communication cards measure 4.0 x 4.0 cm.</p>	<p>The patient must be able to choose the figure form among six options on the notebook sheet.</p> <p>(1) The patient was able to choose a figure among two options on the notebook sheet and hand it to the therapist with their support. (2) The patient was able to choose a figure among three options on the notebook sheet and hand it to the therapist, independently. (3) The patient was able to choose a figure among six options on the notebook sheet and hand it to the therapist with their support.</p>
3	<p>In this phase, the patient is encouraged to be independent in constructing simple sentences, such as "I want x". Support is still provided when necessary. Records were based on the items used in the previous phase; hence, in this phase, the patient must be able to select the card among six options in the notebook sheet and hand it to the therapist in order, independently.</p>		<p>Introducing the communication notebook and forming sentences. The patient must be able to use the communication notebook and build sentences.</p> <p>(1) The patient was able to choose one figure among six options on the notebook sheet and hand it to the therapist autonomously. (2) The patient was able to choose the "I want" figure (to begin forming sentences) and then the preferred figure, with support. (3) The patient was able to choose the "I want" figure (to begin forming sentences) and then the preferred figure, independently.</p>
4	<p>The patient can fully autonomously remove cards from the notebook and build complete sentences of what they want on the sentence strip. Moreover, multiple commands such as "I want x and y" must be encouraged beginning in this phase.</p>	<p>The strip measures 15 x 5 cm, is made in card stock, laminated, and with Velcro tape (13 x 1.5 cm).</p>	<p>The patient must be able to use the communication notebook, build sentences, and hand the sentence strip, requesting multiple items ("I want paper, scissors, and glue".)</p> <p>(1) The patient was able to use the communication notebook, forming sentences with multiple items, with support. (2) The patient was able to use the communication notebook, forming sentences with multiple items, autonomously.</p>



Development of the Demystifying Alternative Communication podcast

Communication difficulties are central points for patients with ASD, their families, and the therapy teams. Understanding language and communication development and creating ways to make them feasible is not only necessary but also a means of broadening inclusion possibilities. In this regard, the podcast entitled “Demystifying Alternative Communication” was developed and produced.

Each episode was designed and constructed based on demands known by the research team in their clinical practice. Hence, they were developed to answer the questions of professionals who directly apply AAC, those who attend to patients who are using AAC, and relatives/guardians who frequently have questions about the tool.

This podcast was organized into 10 episodes, audio-recorded in MP4 format on the Anchor platform, and made available in other digital media, such as Spotify. The episodes were named as follows: Episode 1 – Welcome to the “Demystifying Alternative Communication” podcast; Episode 2 – Let’s get started: What is communication?; Episode 3 – What is alternative communication?; Episode 4 – My child doesn’t speak! Should I start alternative communication?; Episode 5 – What are the myths and true gains of alternative communication?; Episode 6 – Current scientific evidence on alternative communication – part 1; Episode 7 - Current scientific evidence on alternative communication – part 2; Episode 8 – Is alternative communication the same as PECS?; Episode 9 – Alternative communication, communicative intention, and cognition in children with ASD; Episode 10 – A mother and a speech-language-hearing therapist talk about alternative communication.

Data analysis and ethical aspects

The study used descriptive statistics (tables with absolute and relative frequencies). Participants were compared before and after the PAC intervention with Student’s t-test, setting the significance at $p < 0.05$.

RESULTS

The study included 10 participants – six males and four females –, with a mean age of 5.95 ± 3.74 years. All participants had 10 PAC intervention sessions over a mean of 2.9 months.

Initially collected data assessed the recruited participants’ communication, language, and cognitive skills. Since phase 1, the cards were chosen according to each participant’s interest – hence, this stage, which surveyed their initial vocabulary in different categories, was essential to begin the activities.

Each case had specificities regarding the advancements and possible barriers in the intervention process:

Case 1 reached phase 4 but had sensory difficulties.

Case 2 progressed in the communicative intention but not in the proposed intervention phases. Difficulties at home and the participant’s behavior issues at the time of the study may have contributed to less adherence to the communication board on the part of both the child and the family, resulting in their stagnation in phase 1.

Case 3 advanced in both the communicative intention and intervention phases, using the notebook, choosing a card without the therapist’s physical help, and choosing the desired figure among six options (phase 2). However, they did not advance from this point on to the subsequent phases, and the therapist indicated the need for more time to settle the skills acquired in the phase in which the participant was.

Case 4 progressed in cognitive aspects and reached phase 3. This participant had many behavioral difficulties and restricted and repetitive interest in letters and books since the beginning of the treatment. Although their hyperfocus was used as a tool regarding the participant’s interest, it hindered the acquisition of new gains in this intervention process, and the patient did not acquire the autonomy necessary to advance to the next phase.

Case 5 improved their cognitive pattern and communicative intention, reaching phase 2. Behavioral difficulty patterns and changes in family routine may have posed impeditive barriers to greater advancements.

Case 6 reached the last intervention phase (number 6), completing sentences to communicate, such as, “I want castle and princess”. They also improved their communicative intention, vocabulary, and verbalization of functional sentences.

Case 7 used the communication cards without the therapist’s help (phase 2), requiring greater engagement from the child and their parents/guardians to encourage the settlement and progress of acquired skills.

Case 8, since the beginning of the study, had sensory difficulties and motor restlessness in the intervention sessions. They reached phase 2 and had gains in communicative intention.

Case 9 greatly improved their communication and cognition. They also had behavioral gains throughout the intervention that contributed to the progress to phase 4. The family participated actively in the process of introducing PAC, enabling gains to the participant, such as the use of loose words and sentences to communicate.

Case 10 had difficulties to advance possibly due to sensory aspects and stereotypical movements which were difficult to control during the sessions. They

reached phase 2 and improved their communicative intention.

All participants had already settled the recognition, language, and functional communication of the words “dad” and “mom” (people) and already identified their home (place) as a familiar environment. The quality of the initial indications of toys and objects varied according to the participant’s age. Books, shape sorters, and animals were indicated by participants up to 7 years old ($n = 8$), whereas the two participants above 10 years old ($n = 2$) preferred games (Table 2).

Table 2. Participants’ functional vocabulary surveyed in the initial assessment

Case	Age	Toys	Objects	People	Places	Sensory Resources	Social Plays
1	12.5	Owl game, frog memory game, puzzle (specific figures)	-	Mother, father	House, school, Instituto Priorit	Little ball, pop-it	Dancing, tickling
2	13.4	Super-hero games and activities	-	Mother, father, brother	House, Instituto Priorit	Ball	Yes, tickling
3	3.4	Rings, hammer game, tower cups	-	Mother, father, aunt	House, school, Instituto Priorit	Teething toy, ball	Somersault, tickling
4	5.1	Games with letters and books	Cup	Mothers, brother	House, school	Lycra, swing	-
5	3.9	Games (specific figures)	-	Mother, father	House, Instituto Priorit	Purse	-
6	7.6	Castle, dragon, game (specific), plant, princess	-	Mother, father, grandmother	House, school, Instituto Priorit	Bond paper (to wave)	Yes
7	3.6	Ball and books	Pens and crayons	Mother, father	House	Lycra, hammock	Tickling, massage
8	2.4	Ball, shape sorters	Sticks, pots	Mother, father, sister	House	Cream, massage	-
9	3.8	-	Pens, colored pencils	-	-	Sensory rug	Yes
10	3.8	Shape sorters	Pens, colored pencils, paper	Mother, father, brother	House	Ball	Tickling, somersault

The group of children up to 7 years old (2/8) were immediately interested in the communication card (phase 1, first session), favoring the advancement of communicative intention. These participants identified the symbols (letters) in the cards that were being used.

Three participants had restricted interest in sensory objects, whereas the other three participants in the group needed the enlarged communication card (measuring 10 x 15 cm) to facilitate their engagement with the therapist.

The total sample results of the initial and final assessments were not statistically different (Table 3). None of the patients reached the maximum score in the assessments. In the initial assessment, the minimum score was 56/84, and the maximum was 74/84, whereas in the final assessment, they were respectively 36 and 61/84. Despite the lack of significant difference between the subdomains, all participants progressed in the total sum of the communicative intention results – i.e., their scores decreased, obtaining a $\Delta m = 19.5$.

Table 3. Total and subdomain scores in the initial and final assessments*

Assessment	Total	Comprehensive	Expressive	Comprehensive/ Expressive
Initial	67.5 ± 6.53	24.7 ± 3.26	30.4 ± 2.75	12.4 ± 0.84
Final	48.0 ± 10.19	17.6 ± 3.27	23.2 ± 4.91	7.2 ± 2.52
Δ	19.5	7.1	7.2	5.2

Caption: Δ = delta.

* Student's statistical t-test was used to compare the variables, with no significant values: initial ($p = 0.782$) and final ($p = 0.802$).

Table 4 shows the results of the communicative intention questionnaire and the Vineland-3 questionnaire per participant. None of the patients regressed in the cognition variables analyzed. Six out of 10

participants simultaneously progressed in communicative intention and cognition through the communication subdomain, and the other four children progressed in reading skills.

Table 4. Communicative intention and cognition assessment (Vineland-3, communication subdomain) per patient before and after the personalized alternative communication intervention

Case	Age (years)	Communicative Intention*						Vineland-3 – Communication Subdomain							
		Total		Comprehensive		Expressive		Comprehensive/ Expressive		Receptive/ Equivalent Age		Expressive/ Equivalent Age		Writing/ Equivalent Age	
1	12.5	60	45	21	18	27	19	12	8	2.3	2.3	1.4	1.4	5.1	5.1
2	13.4	72	56	28	20	32	28	12	8	1.4	1.4	0.10	0.10	4.2	4.2
3	3.4	71	56	27	19	32	27	12	10	1.0	1.1	0.9	0.10	3.0	3.0
4	5.1	63	36	22	12	29	19	12	5	1.2	1.3	1.6	1.7	4.8	5.1
5	3.9	74	58	27	20	33	28	14	10	1.4	1.7	1.5	1.7	4.2	4.2
6	7.6	56	36	20	14	25	17	11	5	1.8	1.9	1.9	1.10	3.8	3.10
7	3.6	72	61	27	22	32	29	13	10	1.2	1.2	1.1	1.2	<3.0	<3.0
8	2.4	73	55	28	20	32	27	13	8	0.9	1.0	0.8	1.1	-	-
9	3.8	62	36	21	14	29	19	12	3	1.5	1.7	1.4	1.5	3.2	3.7
10	3.8	72	41	26	17	33	19	13	5	1.7	1.7	1.7	1.10	0.4	2.3

* Comprehensive (questions 1 – 8), Expressive (questions 9 – 17), and Comprehensive/Expressive (questions 18 and 19).

The initial interview with the parents/guardians qualitatively showed (data not presented) that they had frequent questions and uncertainties about the method used in the study. There is a gap in the process of informing professionals and families about AC, and many myths still surround its application. This was the main motivation to construct an additional product for this study, the 10-episode podcast in Portuguese, to present scientific data and further clarify the method to professionals and families. This material is available for free on digital platforms; it can be accessed by reading the QR code below (Figure 1).

**Figure 1.** QR Code to access the Demystifying Alternative Communication podcast

DISCUSSION

This study aimed to assess the communicative intention and cognition of participants with ASD before and after an intervention with PAC. It also developed a method application protocol and produced a digital resource – the 10-episode “Demystifying Alternative Communication” podcast – as a tool to spread knowledge and clarification on the topic.

Communication is an important factor for participants with ASD. About 50% of these participants do not develop language naturally or have communication difficulties to meet their daily needs¹⁵. Regardless of the level of severity of the patient with ASD, the lack of efficient communication can impair various domains. High-functioning individuals have greater language skills and perform better in spelling and vocabulary tests than their low-functioning peers. However, both high and low-functioning groups fail complex language tasks, involving figurative language, comprehension, and inferences¹⁶. For instance, central coherence – i.e., the capacity to use the memory to process contextual information to pick up a higher level of meaning – is a main problem faced by both groups¹⁷.

There are currently different resources participants with ASD can use to acquire social communication skills, including AC – which is often incorrectly seen as an exclusively technical resource that does not stimulate or favor human interactions¹⁸. AC functions in an area of multidisciplinary knowledge that addresses the interaction of people with complex communication needs, approaching hand gestures, graphic symbols, voice-assisted technology, and other resources that temporarily or permanently replace or supplement forms of expression regarding unintelligible, nonfunctional, or inexistent speech¹⁹.

This resource is widely recommended for patients with ASD²⁰. Moreover, recent studies show positive results of using such techniques in this population, advancing not only in communication but also in school and social aspects^{21,22}. Repetitive behavior is one of the ASD symptoms that have the potential to improve with tools such as AAC. A recent study pointed out that patients with ASD and low communication skills can use these behaviors to communicate, and AAC is an effective alternative to manage these behaviors²³. Furthermore, communication must be seen as an opportunity for patients with ASD to be included and learn in different school contexts. Creating a structured communication environment helps diminish barriers in different aspects such as socialization and learning²⁴.

This study used low-technology AC – i.e., homemade printed and laminated cards. High-technology resources are increasingly used, including in studies whose participants have ASD²⁵. However, they have an associated cost that is not always feasible for families. The images in the cards were defined based on each participant’s initial assessment results. Also, a written description was inserted in each image for it to be associated with symbols (writing) from the beginning of the process. A recent randomized clinical study compared the use of different low and high technologies in patients with ASD and indicated that both are effective in treating such patients²⁶.

The fact that the participants were already functionally familiar with the images and used them in daily life enabled an additional resource in the protocol, namely: the use of possible reinforcers in the context of communication. Possible reinforcers must be carefully investigated and introduced in AC application. It must be highlighted that using objects, materials, spaces, and so forth can determine these individuals’ communication patterns. Likewise, according to Vygotsky, each child’s conditions must be assessed regarding the organization of their elementary psychological functions and aspects of their neurological capacity for any intervention. Sometimes, participants who do not have these behaviors or interest in the cards may need enlarged cards to use AC.

The list of the participant’s interests (toys, objects, people, places, sensory resources, and social plays) may be related to the interest and functioning of the vocabulary connected to an action (e.g., recognizing their mother or father and calling for them). It may also be related to the restricted and repetitive interests of a given item or play. Restricted and repetitive interest is one of the main characteristics of participants with ASD¹, but the repertoire is individually chosen by each patient. Altogether, these characteristics ratify the importance of individualized assessment and treatment for each patient^{27,28}.

Social plays were present in the initial survey. Knowingly, individuals with ASD are not always naturally receptive to social effort – although in this study, eight out of 10 participants used this resource, increasing reciprocity in social plays and favoring PAC application.

A recent Brazilian study investigated the profile of speech-language-hearing therapists who apply AC, pointing out that most applications were in children and took place in clinical practice. However, there is a lack of specific instruments to apply this method and a need

for further national research, professional training, and family clarification²⁹.

Besides speech-language-hearing professionals, multidisciplinary teams have an essential role in the treatment of participants with ASD, whether or not using AC. Those who are using it should have it available in various environments – not only the home and school but also the multidisciplinary therapy setting can benefit from this resource. Since communication is a process that often depends on other acquired skills – e.g., spatial recognition; sensory, short, and working memory; cognition; focused, shared, multiple, and executive attention –, transdisciplinary work must aim at better communication results. Furthermore, various factors are known to influence each patient's progress, such as the home environment, parental stimulation, the child's interest in communication, and so forth³⁰. The National Center for Autism Evidence and Practice (NCAEP) declared AAC as an evidence-based practice for patients with ASD. Moreover, other materials are elucidating the contributions and advancements this tool provides to patients with ASD³¹.

Parents/guardians have a very important role in the progress of learning of individuals with ASD. Affection is an essential factor to these children's successful follow-up, as the family must be committed, dedicated, persistent, and flexible to adapt their social life, home environment, and routine to meet their needs and respect their limitations that hinder certain changes⁸. A recent study used semi-structured interviews to assess the perception of parents of 13 to 18-year-old adolescents who used AAC. Even though the families found it challenging to use this resource, they also recognized it met important communication needs of both the adolescents and their families³².

Furthermore, the parents' view of their children's difficulties or development at home may provide different responses from those observed in the therapy setting. The findings in this sample demonstrated a reflection on this aspect. All families had the perception that their children needed independence, but they did not understand that such independence is connected to communication. Although some participants could incipiently communicate their needs to their families, the communication would not happen in other settings or with other interlocutors.

The investigations of communication aspects are closely connected to psychological aspects. The main impairments identified are in executive function, which is related to cognitive, behavioral, and, consequently,

language difficulties in individuals with ASD. None of the study patients regressed in the cognitive assessment – communication subdomain. Difficulties in cognitive mechanisms are factors that impact the everyday lives of children with ASD, the quality of their relationships, and their communicative functions³³.

When children pronounce their first words, they already have a cognitive history that contributes to language development. The relationship between communication and cognition is at the center of the discussion of renowned scholars, such as Piaget, Vygotsky, Merleau-Ponty, Pinker, Landau, and so on. In ASD, participants have a great variety of language deficits and nonverbal intelligence quotient (IQ). Normally, children with lower IQs have lower language levels – which may indicate that language and cognition have at least one mechanism in common³⁴.

CONCLUSION

Participants improved in the communicative intention assessment, with higher scores after the intervention which contributed to the participants' communicative intention advancements. Even though the participants' equivalent age was inferior to their real age in the communication subdomain assessment, they progressed in expressive communication, language, and writing.

ACKNOWLEDGMENTS

This study was financed in part by the Fundação de Amparo à Pesquisa Carlos Chagas Filho do Estado do Rio de Janeiro (FAPERJ), Protocol number E-26/211.069/2019 (DNC).

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Authors' contributions:

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