



Augmentative and alternative communication intervention in multiple disabilities and deafblindness: a systematic review

Intervenção com comunicação aumentativa e alternativa na multideficiência e surdocegueira: revisão sistemática

Intervención con comunicación aumentativa y alternativa en la multidiscapacidad y sordoceguera: revisión sistemática

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Abstract

Introduction: Communication is seriously affected in children and young people with multiple disabilities and deafblindness, which makes it a priority area of intervention. **Objective:** Analyse and systematise the literature regarding the intervention with augmentative and alternative communication in children and young people with multiple disabilities and deafblindness, considering the mode of implementation and evaluation of the effectiveness of that intervention. **Methods:** Systematic review of the literature following the PRISMA Statement. The research was carried out in the databases SciELO, LILACS, PubMed and B-On, until May 31st, 2018, using the terms “multiple disabilities”, “deafblindness” and “augmentative and alternative communication” in Portuguese and in English, combined between them. Results: A total of nine articles were selected after careful analysis and the application of strict

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inclusion and exclusion criteria. **Conclusion:** Some differences have been identified concerning the implementation and evaluation of augmentative and alternative communication effectiveness, revealing that further research is needed in order to demonstrate the impact of the use of this tool in the following aspects: multiple natural settings, complex communicative function, communicative partners, frequency of intervention and perceptions of parents / professionals.

Keywords: Communication Disorders; Communication Aids for Disabled; Disabled People; Disabled Children; Effectiveness; Speech, Language and Hearing Sciences.

Resumo

Introdução: A comunicação apresenta-se gravemente afetada em crianças e jovens com multideficiência e surdocegueira, constituindo-se como uma área de intervenção prioritária. **Objetivo:** Analisar e sistematizar a literatura no que diz respeito a intervenção com comunicação aumentativa / alternativa com crianças e jovens com multideficiência e surdocegueira, considerando o modo de implementação e avaliação da eficácia destas intervenções. **Método:** Revisão sistemática da literatura baseada no *PRISMA Statement*. A pesquisa foi realizada nas bases de dados SciELO, LILACS, PubMed e B-On, até à data de 31 de maio de 2018, utilizando os termos “multideficiência”, “surdocegueira” e “comunicação aumentativa e alternativa”, em português e em inglês, combinados entre si. **Resultados:** Um total de nove artigos foram selecionados após cuidadosa análise e atendendo a rigorosos critérios de inclusão e exclusão. **Conclusão:** Algumas discrepâncias foram identificadas quanto ao modo de implementação e avaliação da eficácia de comunicação aumentativa e alternativa, tendo-se concluído que é necessário desenvolver mais investigação que evidencie o impacto do uso desta ferramenta relativamente aos múltiplos contextos naturais, funcionalidade comunicativa mais complexa, instrução de parceiros de comunicação, frequência da intervenção e percepções de pais / profissionais.

Palavras-chave: Transtornos da Comunicação; Auxiliares de Comunicação para Pessoas com Deficiência; Pessoas com Deficiência; Crianças com Deficiência; Eficácia; Fonoaudiologia.

Resumen

Introducción: La comunicación se ve gravemente afectada en niños y jóvenes con multideficiencia y sordoceguera, constituyéndose como una área de intervención prioritaria. **Objetivo:** Analizar y sistematizar la literatura en lo que se refiere a la intervención con comunicación aumentativa y alternativa con niños y jóvenes con multideficiencia y sordoceguera, en lo que se relaciona con el modo de implementación y evaluación de la eficacia en estas intervenciones. **Metodos:** Revisión sistemática de la literatura atendiendo a las conceptualizaciones establecidas por el *PRISMA Statement*. La búsqueda se realizó en las bases de datos SciELO, LILACS, PubMed y B-On, al 31 de mayo, 2018, con los términos “multidiscapacidad”, “sordoceguera” y “comunicación aumentativa y alternativa” en portugués y en inglés, combinados entre sí. **Resultados:** Un total de nueve artículos fueron seleccionados después de un cuidadoso análisis y atendiendo a rigurosos criterios de inclusión y exclusión. **Conclusión:** Algunas discrepancias se identificaron en lo que se refiere al modo de aplicación y evaluación de la eficacia de la comunicación aumentativa y alternativa y se concluyó que es necesario desarrollar más investigación que evidencie el impacto del uso de esta herramienta en lo que respecta a los múltiples contextos naturales, funcionalidad comunicativa compleja, de socios de comunicación, frecuencia de la intervención y percepciones de padres / profesionales.

Palabras clave: Transtornos de la Comunicación; Equipos de Comunicación para Personas con Discapacidad; Personas con Discapacidad; Niños con Discapacidad; Eficacia; Fonoaudiología.

Introduction

Children and youth who experience communication difficulties are at a clear disadvantage in terms of opportunities for access to information, learning and social interaction. This fact is even more worrying when accompanied by other types of impairments that accentuate this difficulty, as in the case of multiple disabilities (MD) and deafblindness (DB).

MD is defined as the simultaneous existence of intellectual, sensory, communicational, motor, behavioural and health impairments, whose repercussions are reflected in gaps in communicative skills, inappropriate behaviours and difficulties in understanding oral language.¹

In this population, the use of speech as a means of communication is often not possible, and there are gaps in the development of functional communication.² Most children with MD cannot communicate orally, and 76% of their identified communicative behaviours in order to make requests are therefore based on body movements (head, trunk, limbs, facial expressions and eyes), while only 18% of those communicative behaviours are related to the production of vocal sounds (laughter, crying, sighs and vocalizations with consonant and vowel emissions), as indicated in the study.²

DB is characterized by the simultaneous loss of sight and hearing, the repercussions of which are manifested in specific needs in the areas of communication, mobility and orientation.³ In this context, the intervention at the communication level is developed by the sense of touch, and possible residual visual and auditory skills, while the stimulation of the other senses can also be used.³

Communication in children / young people with DB is compromised due to the existence of concomitant sensory deficits, which makes the interaction between them and their relatives/peers difficult, often promoting the occurrence of uninterested behaviours on their part.⁴

One can thus conclude that the serious communication limitations existing in both MD and DB are a top priority in the intervention with these children and young people, in order to make them more active and participative.⁵

It is in this sense that an intervention with augmentative and/or alternative communication (AAC) may become useful, referring to the means and techniques of communication in order to

complement speech whenever it is affected (hence the term “augmentative”) or replace it (hence “alternative”), in case it does not develop with the necessary functionality to provide autonomy in communication in different life contexts.⁶

The application of AAC depends on an explicit introduction and teaching, and should take into consideration all aspects inherent to the child/youth in question.⁷ In addition to the profile of that child/youth with MD or DB, it is equally important that the intervention with AAC also takes into account the characteristics of the environment / contexts in which they are inserted, as well as the characteristics of the communicative partners.

This study aims to analyse and systematise the literature regarding the intervention with AAC in children and young people with MD and DB, in terms of how to implement it and evaluate its effectiveness.

Methods

The process of systematic literature review took place in accordance with the *PRISMA Statement* (Preferred Reporting Items for Systematic Reviews and Meta-Analysis).⁹

An extensive literature search was conducted in the following databases: Scientific Electronic Library Online (SciELO), Literatura Latinoamericana Y del Caribe en Ciencias de la Salud (LILACS), Biblioteca do Conhecimento Online (B-On) and Medline/PubMed, using the term combinations “Multideficiência” AND “Surdocegueira” AND “Comunicação aumentativa e alternativa”; “Multideficiência” OR “Surdocegueira” AND “Comunicação aumentativa e alternativa”; (“Multideficiência” OR “Surdocegueira”) AND “Comunicação aumentativa e alternativa”; “Multiple disabilities” AND “Deafblindness” AND “Augmentative and alternative communication”; “Multiple disabilities” OR “Deafblindness” AND “Augmentative and alternative communication”; (“Multiple disabilities” OR “Deafblindness”) AND “Augmentative and alternative communication”. It should be noted that the combinations using parentheses did not show additional results compared to the other combinations. In the B-On database, the combination “Multiple disabilities” OR “Deafblindness” AND “Augmentative and alternative communication” showed a high number of results (14419), which led to the usage of the option “SU – Termos do

Assunto” as a keywords limit, resulting in 1157 articles. The publication period of the present bibliographic research had no minimum limit of date and the period until May 31, 2018 was considered.

The inclusion criteria established were: 1) articles published in scientific magazines/journals; 2) study population: children/young people with MD or DB; 3) studies on the intervention within the AAC context.

The exclusion of studies was based on the following criteria: 1) they did not demonstrate the impact of the usage (or the absence) of AAC in the target population; 2) they were literature review articles, meta-analyses or opinion articles; 3) the samples studied were composed of individuals with MD or DB aged over 20 years.

This method replicates the one used in previous studies (poster and article included in the minutes

of the Research Days, promoted by Fernando Pessoa University). Part of this study was presented in poster format at the 10th European Congress of Speech and Language Therapy promoted by CPLOL, from 10th to 12th May 2018, in Cascais - Portugal (method, brief description of the results and main conclusions).

The search in the chosen databases identified a total of 2669 articles which, after the removal of duplicate articles, revealed a total of 1008 articles for analysis. In the first selection, based on content analysis by title and abstract reading, a total of 969 articles were excluded, remaining 39 articles eligible for full reading. After reading the entire content, 30 of the 39 eligible articles were excluded, leaving a total of 9 articles to be included in this study (Figure 1)

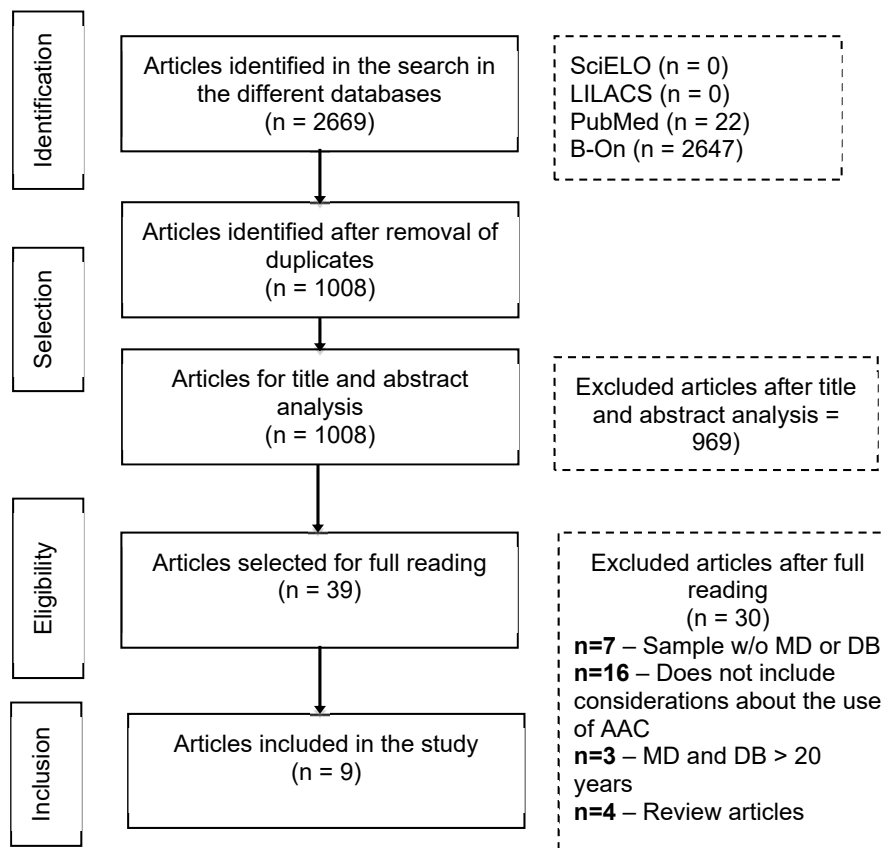


Figure 1. Flowchart of the literature review based on PRISMA recommendations

Since the final number of included studies is small (N=9), we chose to analyse all the articles, regardless of their methodological quality.

Results

Chart 1 shows a brief characterization of the studies reviewed, with a reference to their research objectives and participants.

Chart 1. Characterization of the analysed studies in terms of research objectives and participants.

Article	Research objectives	Participants
Sigafoos et al. (1996) ¹⁰	Demonstrate effective procedures in teaching, generalization and differentiation of graphic symbols to facilitate requests of two distinct categories (food and drink).	2 children with MD, aged 5 and 6 years old.
Cohen et al. (2001) ¹¹	Investigate the effectiveness of the use of "Picture dictionaries" in meaningful communication with colleagues, supervisors and other stakeholders in the work environment.	3 young people with deafness and moderate intellectual disability, aged 17, 18 and 20 years old.
Cosbey e Johnston (2006) ¹²	Examine the outcome of an intervention using voice output communication aid (VOCA) and physical aids to promote social interactions with peers.	3 children with MD, aged 3, 4 and 6 years old.
Trief (2007) ¹³	Report the introduction of a communication system based on tangible symbols.	25 children / young people with MD (all with visual impairments), aged between 4 and 16 years old.
Brady e Bashinski (2008) ¹⁴	Describe the program "Adapted version of prelinguistic milieu teaching (A-PMT)"; Report the results obtained from the use of A-PMT.	9 children with DB, aged between 3 and 7 years old.
Lancioni et al. (2008) ¹⁵	Assess the combined use of two microswitches and VOCA to request social interaction.	2 young people with MD, aged 16 and 18 years old.
Lancioni et al. (2009) ¹⁶	Study I: Find new evidence regarding the use of microswitches and VOCA with a larger sample of participants; Study II: Socially validate the use of microswitches and VOCA.	11 children / young people with MD, aged between 5 and 18 years old.
Lee, Jeong e Kim (2013) ¹⁷	Investigate the effectiveness of an intervention with AAC with VOCA in the increase of communicative behaviours after placement of a cochlear implant.	10 children with MD, aged between 5 and 11 years old (5 elements in the intervention group and 5 elements in the control group).
Trief, Cascella e Bruce (2013) ¹⁸	Determine the percentage of identification of tangible symbols for each participant; Identify the factors that had the greatest impact on that identification;	43 children with MD, aged between 3 and 20 years old (intervention group), and 10 children with MD, aged between 3 and 20 years old (control group).

Chart 2 highlights the main aspects related to the mode of implementation of AAC in the analysed studies. Thus, the method used, the intervention

contexts, the communicative partners involved and the duration of the intervention are identified.

Chart 2. Main aspects of the analysed studies in relation to the implementation of intervention with AAC.

Article	Method	Intervention contexts	Communicative partners	Intervention duration
Sigafoos et al (1996) ¹⁰	<ul style="list-style-type: none"> - Implementation of COMPIC symbols; - Choice of food/drink of the participants' preference; - Phases of baseline, intervention and follow-up; - Implementation developed in an individual way. 	School (during midmorning snack)	Main teachers	Total time not explicit
Cohen et al (2001) ¹¹	<ul style="list-style-type: none"> - Implementation of Picture Dictionaries, built according to the specificities and work needs of each participant, consisting of pages with SPC symbols, accompanied by words or sentences that described them; - Pre-intervention phase (educational context), in which the specific skills needed by the participants in order to use the Picture Dictionaries were verified; - Intervention phase (educational context): 1st part - perception of the purposefulness of the use of Picture Dictionaries and the meaning of the symbols contained in it; 2nd part - learning how to use Picture Dictionaries effectively; - Generalization phase (work context): participants moved on to this phase when they reached 80% effectiveness in the second phase of training. No instructions were provided to the participants in this phase. 	School and work	School context: researchers; Work context: supervisors, colleagues and clients	Total time of the intervention and duration of each implementation phase not clear
Cosbey e Johnston (2006) ¹²	<ul style="list-style-type: none"> - Implementation of a simple switch connected to a VOCA device; - Pre-intervention phase: determination of toys of each participant's preference to be used in the intervention; - Intervention phase: each participant's request to access an object of his/her preference or to interact with a classmate, activating the VOCA switch (programmed with sentences) independently and in a way adapted to his/her mobility profiles; - Follow-up sessions: started 1 week after the end of the intervention, covering only 2 of the 3 participants, without the presence of the person who implemented the AAC, and without the presence of any physical aids.. 	School (classroom), during free activities time and in a normal way	Classmates	Not explicit
Trief (2007) ¹³	<ul style="list-style-type: none"> - Implementation of AAC, in daily sessions, based on simple instructions on daily routines, and subsequent choice of symbols by participants; - Implementation of 28 tangible symbols chosen by professionals in an educational context. 	School	School staff (teachers, auxiliary staff or therapists)	Between September 2004 and June 2005
Brady e Bashinski (2008) ¹⁴	<ul style="list-style-type: none"> - One-on-one sessions, lasting 30 to 60 minutes, 4 times a week; - The sessions were similar for all participants in terms of duration and structure, with individualized activities and routines; - Implementation of the A-PMT, based on the participant's involvement in activities/routines of their choice, in order to promote a communicative environment and build a social routine. 	School	Researchers who applied the A-PMT	Between 2,5 and 8 months
Lancioni et al (2008) ¹⁵	<ul style="list-style-type: none"> - Implementation of two microswitches associated with a VOCA; - Initiation by selecting responses (body movements and vocalizations) that can activate the microswitches and the VOCA; - The baseline and later intervention phases were then applied by the research assistants, who also collected data; - 4 to 8 sessions per day, lasting 10 minutes; - The post-intervention phase started one and a half months later and was divided into 12 sessions. 	Not explicit	Carers of the young people with MD	Total time not explicit
Lancioni et al (2009) ¹⁶	<p>Study I:</p> <ul style="list-style-type: none"> - Implementation of microswitches with VOCA; - Stages of baseline and intervention, in three different moments: 1st only with the use of microswitches; 2nd only with the use of VOCA; 3rd with the use of microswitches and VOCA at the same time; - Post-intervention phase: started 1 month after the end of the intervention, consisting of 14 sessions; - 3 to 11 daily sessions, lasting between 5 and 10 minutes; <p>Study II:</p> <ul style="list-style-type: none"> - Validation by 110 psychology students; - Visualization of videos of intervention sessions with the participants by the students, in order to validate on which of the three methods was most effective (only microswitches; only VOCA; microswitches and VOCA together). Explanation by the research assistants about the procedures followed during the intervention and their purpose. 	Home and school	Auxiliary staff acquainted with participants	Total time not explicit

Article	Method	Intervention contexts	Communicative partners	Intervention duration
Lee, Jeong e Kim (2013) ¹⁷	<ul style="list-style-type: none">- Implementation of a VOCA device (KidsVoice Device);- Before and after the intervention, the participants of both groups were evaluated regarding speech perception, speech production, receptive vocabulary and frequency of communicative behaviours;- The intervention involved participants and parents in sessions of 1 hour per week, based on direct teaching of participants and training for parents in order to promote communication skills;- The teaching of symbols was based on objects of preference of the participants. The sessions were based on activities similar to the daily routines of school and home, promoting the use of VOCA at home.	Home and school	Parents	6 months
Trief, Cascella e Bruce (2013) ¹⁸	<ul style="list-style-type: none">- Introduction of tangible symbols to the intervention group (55 tangible symbols for school use, developed by Trief, Bruce, Cascella and Ivy, 2009), to be used for purposes like requesting the presence of people, objects, direct attention or make choices between activities;- The sessions were attended daily and the symbols were introduced during the participants' routine;- Pre- and post-intervention phases performed three to four weeks before and after the intervention;- In addition to their presentation by the communicative partners to each participant, the tangible symbols were also presented in a calendar format in which the participants' daily routines were guided, thus regulating the transition between the different activities to be developed each day.	School	Teachers and therapists	7 months

Chart 3 presents a summary of the main results obtained in the reviewed studies, as well as of the instruments and procedures adopted in order to

assess the effectiveness of the implementation of AAC.

Chart 3. Main aspects of the reviewed studies concerning the analysis of the effectiveness of the intervention with AAC.

Article	Main results	AAC implementation assessment (tools and procedures)
Sigafoos et al (1996) ¹⁰	<ul style="list-style-type: none"> - The use of COMPIC symbols was positive in the development of skills for ordering food and drink; - The strategy of adding a differentiated line colouring to the COMPIC symbols proved to be an effective strategy to address the participants' difficulties in discriminating.. 	<ul style="list-style-type: none"> - The way in which the records have been made is not explicit.
Cohen et al (2001) ¹¹	<ul style="list-style-type: none"> - The 3 participants used the Picture Dictionaries to produce written notes as the primary form of expressive communication; - The number of lost communication opportunities decreased compared to the beginning of the intervention; however, their frequency was variable, according to the tasks, barriers and number of clients in the workplace; - The possibility of communicating through writing allowed participants to ask specific questions about the work context or make comments at a social level that would otherwise (through gestures) have been less successful/perceivable. 	<ul style="list-style-type: none"> - Data retrieval / results at all stages of the intervention. However, the way in which these data were retrieved / organized and the method used for that purpose are not clearly explained; - Questionnaire to participants on the effectiveness of the use of Picture Dictionaries.
Cosbrey e Johnston (2006) ¹²	<ul style="list-style-type: none"> - Gradual increase in the use of VOCA without prompts by all participants; - The participants achieved results of 84%, 87% and 70% of individual percentage of correct answers in the use of VOCA to initiate interactions with their peers in the 2nd phase of intervention; - In the generalization phase, the percentages of answers without prompts of 2 participants were 55% and 20%, having decreased compared to the intervention phase. However, the authors highlight this percentages as positive, since there is still some percentage of response in comparison with the initial phase of the study (baseline); - Professionals in the educational context considered the use of VOCA to be positive in the participants' communication, namely in terms of effectiveness and accessibility. 	<ul style="list-style-type: none"> - Data retrieval regarding the effectiveness of the intervention with AAC was carried out in all phases of the study (baseline, intervention and follow-up); - Data were recorded in a coding form with regard to the onset of interactions in response to peers (mediated by the objects of preference), the use of prompts by the person in charge, as well as the corrections and responses of peers to the interaction initiated by the participants; - Direct observation of participants in a classroom context; - The use of a questionnaire for education professionals to collect their perceptions regarding the effectiveness and level of acceptance of the use of VOCA.
Trief (2007) ¹³	<ul style="list-style-type: none"> - The most iconic tangible symbols were used more frequently than the less iconic ones; - All of the introduced tangible symbols (28) were effectively seized by 5 of the 25 participants; 10 participants seized between 1 and 20 tangible symbols; - The use of tangible symbols allowed the 15 participants mentioned above to express needs, choices and understand daily routines (from 3% to 73% of correct answers); - The remaining 10 participants did not achieve any progress in this area. These were the children/young people with most severe cognitive, motor and visual impairments.. 	<ul style="list-style-type: none"> - The participants' answers were recorded weekly in forms created for each one; - The data were analysed by comparing the number of correct answers with the number of daily attempts.
Brady e Bashinski (2008) ¹⁴	<ul style="list-style-type: none"> - Increase of the communicative initiative in all children with DB; - Decrease in the number of stimuli to initiate communication in 7 of the 9 children with DB; - 8 of the 9 participants showed a higher diversity of forms of communication; - Improvements in the use of communicative actions related to the regulation of behaviours (requests and rejections); - Increase in communicative actions associated with social interaction in 6 children. However, only 2 used these actions to communicate socially on a frequent basis; - Only 1 participant demonstrated an increase in communicative actions related to joint attention. 	<ul style="list-style-type: none"> - Video recording of 1 of the 4 weekly sessions held with each participant; - Observation of the recordings by 2 independent reviewers (students), to identify each participant's ICA (intentional communicative acts) (initiation, response to question or stimulus), the way this ICA occurred (gestures, vocalizations, verbalisation, distal points or signs) and the communicative function of each ICA (regulation of behaviour, joint attention or social interaction).
Lancioni et al (2008) ¹⁵	<ul style="list-style-type: none"> - Increased number of responses with microswitches and VOCA, with statistically significant results in the different options; - The frequency of use of microswitches and VOCA varied considerably during the sessions, suggesting that participants made choices; - In the post-intervention phase, the results were equivalent to those observed in the intervention phase for one of the participants (youth) with MD, and slightly lower for the other youth; - Microswitches and VOCA were a positive strategy, which allowed participants to access their environment and have opportunities to choose (establish social contact, ask for help or meet basic needs). 	<ul style="list-style-type: none"> - Recording of the number of responses produced by participants, independent of prompts, both in relation to microswitches and VOCA; - Data collected at all stages of the research; - The material or means used for recording the research data are not explicit.
Lancioni et al (2009) ¹⁶	<ul style="list-style-type: none"> - Study I: The participants' responses showed a statistically significant increase since the baseline phase until the intervention; the participants demonstrated the ability to interact independently with their environment, seeking stimuli and attention/social contact, despite the existence of certain individual variations; - Study II: in the post-intervention phase, the results were maintained in the majority of participants; the intervention regarding the combined use of microswitches and VOCA was considered by the reviewers to be more effective than their isolated use, with an 85% preference for this combined strategy. 	<ul style="list-style-type: none"> - Study I: responses in both microswitches and VOCA were recorded by an electronic control system at all stages of the investigation; - Study II: visualisation of recordings of the participants' sessions (two for each participant); psychology students, divided into groups, observed different recordings of the same participant, to which they assigned a score based on four questions.

Article	Main results	AAC implementation assessment (tools and procedures)
Lee, Jeong e Kim (2013) ¹⁷	<ul style="list-style-type: none">- The experimental group significantly improved its performance in the fields of perception and production of speech and receptive vocabulary after intervention with AAC (statistically significant results);- Increased communicative behaviours in the experimental group;- There were no improvements in the parameters mentioned above in the control group.	<ul style="list-style-type: none">- Pre- and post-intervention evaluations of the following parameters: speech perception, speech production and receptive vocabulary;- Observation of communicative behaviours recorded on video, before and after the intervention (during free interactions between parents and children) and encoded in a form created for this purpose.
Trief, Cascella e Bruce (2013) ¹⁸	<ul style="list-style-type: none">- The participants corresponded to the intervention with the tangible symbols, gradually increasing their communicative skills up to 46% between the 4th and 7th month of intervention;- Participants with more severe impairments also made progress in identifying the tangible symbols used;- Participants with higher levels of mobility achieved greater progress.	<ul style="list-style-type: none">- The follow-up visits were recorded on video and there was direct feedback to assess the intervention procedures;- After completion of the study, 12 recordings were randomly selected and analysed, to ensure the accuracy of the intervention;- Knowledge of tangible symbols was assessed by individual tests (exposure to tangible symbols) before and after the intervention by one author and three collaborators;- In the intervention phase, data on tangible symbols were collected - according to the exposure to the latter and the response of each participant - and described in a form created for this purpose.

Finally, Chart 4 describes some of the considerations made by the authors of the studies that reinforce their contribution.

Chart 1 shows that the oldest study of those included in this review was published in 1996 and the most recent in 2013 - when two studies were published, as in 2008. Two of the selected studies were developed by the same main author. In terms of their objectives, the selected studies in general aim to implement, analyse and describe results with regard to the implementation of different types of AAC.

The participants in the studies included in the review were children and young people with MD or DB, aged between 3 and 20 years, with a minimum of 2 and a maximum of 43 participants in the samples. Of the nine studies selected, one was conducted with children with DB and eight with children and young people with MD.

As to the mode of implementation (Chart 2), five points stand out regarding differentiating aspects between the studies, which will be discussed later: the typology of the intervention with AAC (four of the studies made use of VOCA (Voice Output Communication Aid), two of tangible symbols, one of graphic symbols, one of "Picture Dictionaries" and one of a specific program, the A-PMT (Adapted version of Prelinguistic Milieu Teaching)); the exploration of different contexts of intervention (school, school and home and school and work); the daily routines of participants and their preferences; the communicative partners (either known or unknown by the participants); and the duration of the intervention.

Regarding the assessment of efficacy (Chart 3), discrepancies were noted in the instruments used (video, record sheets/coding forms), in the collection of perceptions and in the post-intervention / follow-up.

Chart 4. Main considerations of the authors regarding their research on intervention with AAC.

Article	Authors' considerations
Sigafoos et al (1996) ¹⁰	<ul style="list-style-type: none"> - The authors consider the hypothesis that the good results achieved by the participants are due to a hypothesis of "trial and error", and therefore this matter should be reviewed in a future research; - Some aspects of the intervention need to be reviewed for a future study, e.g. the fact that several items were considered for the request for food, while only one was considered for the request for drink - and this was presented in the same glass throughout the sessions; - The fact that the drink was presented in the same glass may have led the participants to associate the COMPIC symbol with the glass and not with the drink; in a future investigation, other times of the day should be considered when children with MD may show signs of hunger or thirst, in order to verify if there was generalisation of the trained requests.
Cohen et al (2001) ¹¹	<ul style="list-style-type: none"> - <i>The use of Picture Dictionaries for written notes assumes that the communication partner has literacy skills, which may not always be the case;</i> - <i>The use of Picture Dictionaries for written notes may give communicative partners the idea that the young person with MD may have a more advanced level of literacy than he or she actually does;</i> - <i>Occasional impatience shown by the clients regarding the time taken by the participants to write the notes;</i> - <i>Need for future studies with participants with different levels of literacy, in different life contexts;</i> - <i>Need for further research on the individual characteristics required for the successful use of Picture Dictionaries.</i>
Cosbey e Johnston (2006) ¹²	<ul style="list-style-type: none"> - Need to give more explicit instructions to peers on strategies for interacting with children with MD; - Need for more research with educational professionals as people who take part in the process, covering the following aspects: determine which elements of the strategy of this intervention contributed most to the use of VOCA; use more complex AAC systems with the same population, that promote variability in the form and function of communicative interactions; the intentions of children with MD when activating a VOCA; the contribution of AAC in promoting non-symbolic communicative skills and the transition from symbolic language to verbalization.
Trief (2007) ¹³	<ul style="list-style-type: none"> - Characteristics inherent to the communicative partners themselves (personality and relationship with the participants) may have influenced the acquisition of tangible symbols, although this hypothesis was not considered in this study; - Difficulties were acknowledged in determining whether a child or young person with MD is a potential candidate for using AAC without initial screening; - Importance of the choice and creation of tangible symbols, which should be carefully considered, taking always into account what they represent; - Intervention should be consistent on the part of communicative partners in the use of tangible symbols, attending to their presentation in times / routines, in order to facilitate the association of the symbols to activities.
Brady e Bashinski (2008) ¹⁴	<ul style="list-style-type: none"> - The use of natural gestures was an advantage in communication, since they are easily understood by several communicative partners in each child's cultural group; - Need for further research related to the use of pre-linguistic aspects in the intervention with A-PMT in activities and in natural contexts; - Many communicative behaviours were not reinforced, both by teachers and parents, and several opportunities to establish communication were missed; - Need for training communicative partners on the value of communication through gestures and on how to promote that kind of communication in daily interactions.
Lancioni et al (2008) ¹⁵	<ul style="list-style-type: none"> - Evidence of the use of microswitches and VOCA is still limited, so it will be important to continue the investigation with them; - Need for further research on sample variability and generalisation of acquired skills; - It will be important to collect the perceptions of parents, professionals and caregivers about the use of microswitches and VOCA, for social validation of these tools.
Lancioni et al (2009) ¹⁶	<ul style="list-style-type: none"> - The results of this research are in line with the results of previous studies on this topic; - The combination of VOCA and microswitches suggests that people with MD can directly access stimuli from their environment and seek social interaction; - Need for future research on the effectiveness of the use of microswitches and VOCA in the population with MD, with new devices; - Suggested social validation of these devices with other groups of stakeholders such as parents, educational professionals, caregivers and social service technicians.
Lee, Jeong e Kim (2013) ¹⁷	<ul style="list-style-type: none"> - Intervention with AAC with VOCA did not constitute a barrier to the development of oral verbal communication and did not inhibit the development of other functional forms of communication; - Parents and teachers felt that the acquisition of symbols was difficult for participants due to their cognitive limitations; they felt the need for new communication strategies in order to help them advance beyond the pre-linguistic level; - Need for a follow-up phase; - Need for future research, to reduplicate this study with other children with MD and cochlear implants in order to validate the intervention procedures and test the increase in the performance of communicative skills..

Article	Authors' considerations
Trief, Cascella e Bruce (2013) ¹⁸	<ul style="list-style-type: none">- Children/young people with MD require a prolonged intervention over time in order to make progress, so it is important that teachers spend considerable time on intervention with tangible symbols;- The fact that there have been some "delays" in responses by some participants has demonstrated the importance of the necessary perseverance and patience on the part of the educators;- Limitations in the study related to variations in interaction with participants and in the presentation of symbols by teachers, and a possible previous exposure to objects considered as tangible symbols;- Need for future research on children's abilities to generalise the use of tangible symbols during the day at school and to search for and use a tangible symbol independently, as well as on curricular adaptations for the AAC;- In the future, it will be important to consider expanding the use of tangible symbols to other contexts, introducing new symbols, customizing symbols to meet the specific needs of users, using VOCA in combination with tangible symbols and the permanent use of symbols in the home context.

Discussion

According to the results presented (based on the analysis of the articles included in this study), the intervention with AAC represents a positive aspect for the population with MD and DB. The use of AAC has been studied over time and its benefits in various issues have been proven.¹⁹ Regarding children/young people with MD and DB, the benefits are also notorious.²⁰⁻²³ However, due to the complexity of the situations and the heterogeneity of the needs, research in this area is still scarce and requires further study.

The interventions with AAC described in the nine articles selected for this systematic review show some differences in terms of their implementation and assessment of their effectiveness, which will be discussed below.

Implementation strategy

Typology of the intervention with AAC

In the interventions described in the selected studies, different AAC instruments were used: VOCA (Voice Output Communication Aid),^{12,15-17} tangible symbols,^{13,18} graphic symbols,¹⁰ "Picture Dictionaries"¹¹ and a specific program, the A-PMT (Adapted version of Prelinguistic Milieu Teaching).¹⁴

In all the studies mentioned, the participants achieved some evolution in their communicative skills, regardless of the AAC system used, as long as the latter were appropriate for the participant. In fact, the entire typology of the AAC system aims to increase the communication competences and participation in the society of those who use them. However, they need to be adapted to the profile of their future users.⁸ Nonetheless, the existence of research that allows a comparison between different

types of AAC systems in specific pathologies - in terms of their effectiveness - would be of great interest to parents and professionals.²⁴

The results obtained in this study reinforce what has already been highlighted in the literature regarding the use of switches and devices with voice output, which seem to have a significant positive effect,^{22,23,25} with an impact on the surrounding environment and on the interaction with others.

Intervention contexts

Concerning the intervention contexts, five studies were developed exclusively in a school context,^{10,12,13,14,18} two considered the school and home contexts for the intervention^{16,17} and one was developed both in a school (only the initial learning part of the use of "Picture Dictionaries") and in a work context.¹¹ In one of the studies, the intervention context is not explicit.¹⁵

The exploration of different intervention contexts is an extremely important point and the authors' concern to include different reference contexts for the participants is very positive, especially in research that involved more than one intervention context. The context in which the participant is inserted for the implementation of the AAC has been referred to by several authors^{8,26,27} as highly relevant, since communication is not an end, but a tool that allows the child / young person to initiate and maintain interactions. Therefore, it is essential that the intervention in this area covers all the natural contexts of the participant. This is the only way for it to achieve its objectives: effective participation in society and access to various services in the community.^{7,19} Urie Bronfenbrenner's Bioecological Theory of Human Development reinforces the conceptual framework of this premise, emphasizing the importance of the various contexts, at the vari-

ous levels of the system, their inter-influence and the reciprocity of interactions and interrelations in development.²⁸

Specifically in the field of the AAC, the Participation Model⁸ stands out, as it identifies the fundamental aspects of an integrated vision of the communication competences in order to contribute to the participation of people with complex communication needs in their own life contexts, considering their specific characteristics as well as the barriers and the support that constitute opportunities for them.

Preferences / daily routines as implementation means for AAC

Five of the selected studies considered the daily routines (school and home)^{11,13,14,17,18} and three considered the participants' preferences (namely, activities, toys and food).^{10,12,17} Both approaches were used in the implementation of AAC in order to require activities/preferences that meet participants' needs or to require social contact with caregivers or peers and, thus, allow children/young people with MD or DB to initiate interactions with the surrounding environment. These strategies are widely recognised in the literature as means that promote significant interactions in natural environments.²⁹⁻³²

A study on intervention decisions in communication by speech and language therapists showed that the use of reference objects for children and adults with complex communication needs was the strategy most frequently mentioned by these professionals in their intervention, since those objects seem to anticipate events, reduce anxiety levels and facilitate interactions.²⁵

Indeed, the use of the participants' preferences or daily routines seems to be an effective tool in the implementation of AAC at an early stage. However, it ends up being constraining in the development of communication/social skills in the long run.^{7,33} In an intervention with AAC, it is essential that the focus on communication as a whole be maintained, since, despite the importance of the expression of satisfaction of the needs to the activities of daily living, that is not sufficient to allow the child/youth with MD or DB to develop skills that promote social relationships and information exchange.¹⁹ Therefore, It is not surprising that individuals with complex communication needs show marked difficulties in the areas mentioned above, as these competences have not been properly intervened.¹⁹

Individuals with MD, due to the complexity, severity and heterogeneity of their needs, do not acquire communication skills in a conventional way, so more research is needed on these specific field regarding this type of population.³³

The lack of published scientific evidence regarding the implementation of various approaches/strategies indicates the need for further specific research with this population.²⁵

Communicative partners

Regarding communicative partners, in eight of the studies the partners were known to the participants (school professionals, parents, caregivers, co-workers or peers)^{10-13,15-18} and only in one were the communicative partners unknown (these were the researchers themselves).¹⁴

Communicative partners can be defined as people who share routines and experiences and have relationships of a social (family, peers and colleagues) and of an educational and care nature (school and health professionals) with the individual who uses the AAC, and are facilitators in the communication process³⁴. The fact that researchers also take part in the process can be seen as a disadvantage, as it renders unclear the possibility of transferring the intervention to environments in which communicative partners do not have the same level of knowledge/experience.³³

Indeed, in typical development situations, communicative partners are fundamental elements in the process of acquisition and development of speech and language, providing constant models in environments that are rich in quality interactions.³⁵ In the case of children/young people with complex communication needs, the process of language acquisition and development can be facilitated with the implementation of AAC, and the experiences will be significantly different, highlighting two main aspects: the moments of adaptation to the communication system occur at a much lower rate, and the same happens with the participation and involvement in interactions/activities that give those children/young people the opportunity to use the communication system. Both situations have a significantly negative impact on the development of communication skills in children/young people with complex communication needs.³⁵

However, even though communicative partners play an extremely important role in the implementation of AAC, interventions in this area tend

to focus more on the participant himself and his characteristics, with minimal attention being paid to the communicative partner and his education.¹⁹

Studies found that communicative partners were not always able to respond to the participants' communicative behaviours, due to difficulties in understanding them.^{2,36} Thus, it can be inferred that there is a need to educate/train the communicative partners of children and young people with MD and DB in order to provide them with knowledge and strategies that enable them to identify and respond properly to communicative behaviours. Of the selected studies, only one refers in its methods the explicit training for parents as a means to promote communication skills.¹⁷ Nevertheless, training communicative partners is a highly effective approach, as it provides them with strategies that modify their interaction, which is a positive aspect in communicating with children and youth using AAC.³⁷

It can then be concluded that the training of communicative partners should continue to be explored in future investigations with this population and more frequently, due to the important role that it plays in the implementation of AAC

Frequency and duration of the intervention

The frequency of implementation sessions, as well as the duration of the intervention, show significant variability among the different studies selected, which is not always explicit. In general, regarding frequency, the minimum duration of the sessions was 5 minutes and the maximum 60 minutes, with only six of the nine studies mentioning the exact duration of the sessions with the participants.^{11,12,14-17} Regarding the duration of the intervention, only four of the nine studies explicitly mentioned the total duration of the intervention, with a minimum of 2.5 months and a maximum of 9 months.^{13,14,17,18}

The lack of clarification regarding these parameters is in line with the literature in general, as the majority of the studies focusing on intervention with AAC are unclear as to the frequency and duration of that intervention, which does not allow an in-depth analysis of the impact of its intensity^{33,38}.

The duration of the sessions was more frequently described in the selected studies in comparison to the duration of the intervention. However, it is not a favourable factor for quantification due to the fact that there are several variables that

may influence it.³³ On the other hand, the duration of the intervention may have an impact on future investigations, providing important data on the effectiveness of the intervention, generating bases for the implementation of evidence-based practices and allowing for the comparison of different types of intervention.³³ Thus, an in-depth analysis of the parameters of intervention frequency and duration will allow professionals who implement it to clarify the quality and quantity of their interventions³⁸ and is therefore an essential point to consider in future investigations.

Assessment of effectiveness

The effectiveness analysis was carried out in different ways by the researchers. However, it is not always clear what method or procedures were followed. A common point to all selected investigations is the fact that the analysed data were all obtained from interventions with children/young people with MD and DB.

In this part of this study, we will discuss the most relevant aspects found in the nine studies which allowed us to assess the effectiveness of the reported interventions: the instruments used, the survey of perceptions and the existence/absence of a follow-up phase.

Instruments

For the purpose of collecting data from the research itself, some authors have used video recordings.^{14,16,17,18}

Another instrument mentioned in four of the nine studies was the creation of record sheets/coding forms in accordance with the purpose of the investigations^{12,13,17,18}.

Both the recordings and the creation of recording methods were intended to codify communicative behaviours and ensure the reliability of the investigation, according to what was mentioned by the researchers who used them. However, it should be noted that in three studies it is not clear which instruments were used.^{10,11,15}

The employment of methods of recording communicative behaviours appears to be a positive procedure in terms of structuring the information and facilitating the analysis of results, enabling the drawing of conclusions about the effectiveness of the application of a given program.⁸ However, the fact that the instruments used in an investigation are not always explicit may lead to gaps in the

understanding of the organization and analysis of the obtained data, which will hinder future studies or replications of certain investigations.³³

Another instrument used was the questionnaire to survey perceptions, which will be discussed below.

Perceptions survey

A key aspect that allows precise considerations to be made about the effectiveness of an AAC intervention is the survey of the stakeholders' perceptions of the process. Only two of the selected studies refer to this practice. In one of them, a five-question questionnaire with five-point Likert scale answers was applied to the users of "Picture Dictionaries".¹¹ This measure gave the authors accurate information on the positive and negative aspects of using this AAC instrument with young people with MD. In the other study, a questionnaire with Likert scale answers was also applied, this time to the professionals who accompanied the children with MD in their sample.¹² This procedure allowed us to reach important conclusions on the use of VOCA, from the perspective of who is most in contact with these children in a school setting.

In one of the selected studies, although no questionnaire was used, the importance of the perceptions of parents, professionals and caregivers was recognized, and this aspect was highlighted as a point to be taken into account in future investigations.¹⁵

The literature shows that parental involvement throughout the intervention process is an added value in terms of information and access to data about the parents' responsibilities and frustration with the AAC.³⁹ The importance of the involvement of the multidisciplinary team in the inclusion of students with special needs using AAC is also mentioned.⁴⁰

Studies on the perceptions of professionals and parents highlight the importance of these perceptions, since they allow the collection of relevant data on the communication skills of users, the facilitators, the barriers and the effects of training in the use of AAC, which may prove to be of great significance for a successful intervention in this field.^{41,42}

Another study, this time related with the experiences and perceptions of speech and language therapists about the factors that influence the implementation of interventions at the level of

communication with children/young people with MD, identified several aspects: experience and skills of these professionals, professional development, collaboration with teachers and families, home and educational contexts, the role of public institutions and social factors.⁴³ It also mentioned that these complex subjects direct towards the need for a systemic support approach, at various levels, in order to facilitate an effective implementation of the intervention at the level of communication with children/young people with MD⁴³.

This should therefore be an important guiding point to be considered in future investigations.

Follow-up

The follow-up, or post-intervention phase, emerged as another important aspect in the assessment of the effectiveness of the intervention with AAC.

Five of the selected studies included a post-intervention phase in their method.^{10,12,15,16,18} In this phase, the authors were able to determine if the results achieved during the intervention with AAC were maintained and if the participants had actually acquired communication competences. It is important to mention that the authors of one of the studies, despite not including this phase in their research, marked that fact as a shortcoming of their study.¹⁷

If after a period of structured intervention it is once again observed that the developed competences are still maintained and continue to be applied in the natural context, that situation can be seen as a strong indicator of the effectiveness of the AAC instrument (just like the lack of results would be of its abandonment);⁴⁴ however, only four of the nine studies selected included this phase in their research.

There is evidence that few studies carry out this phase, which leads to a weak understanding regarding the use of AAC in terms of how this instrument is acquired by participants, when and how generalization occurs and how variables facilitate or limit it.³³ Thus, special attention should be paid in cases of AAC researches with participants with MD, in order to make sure that the intervention is not abandoned if there is no immediate progress.³³

Most of the research carried out in the field of AAC focuses on the effects of the intervention in the short term, highlighting the important advances to which it has led.¹⁹ However, there is also a need

to build a more holistic view of the intervention with people with complex communication needs, and research is needed to consider the long-term impact of this tool.¹⁹

Conclusion

The analysis of the articles included in this systematic literature review allows us to conclude that, although the intervention with AAC is of great importance in increasing communication skills in children and young people with MD and DB - regardless of the type of AAC instrument used-, there are discrepancies in terms of its implementation mode and analysis of effectiveness.

As far as the mode of implementation is concerned, the analysis of the data revealed the need for intervention with AAC to cover as many of the natural contexts in which the participants are inserted as possible; to attend not only to communication skills related to the regulation of behaviours but also to others related to the promotion of social relations and long-term information exchange; to instruct communicative partners in the use of AAC; and to clarify aspects related to the frequency and duration of the intervention with AAC.

Concerning the analysis of effectiveness, key aspects were not always taken into consideration, such as the identification and explanation of the data collection instruments used, the perception of parents or professionals regarding the implementation of the different AAC instruments or the existence of a follow-up phase to measure the real effectiveness of AAC use.

Thus, it would be important to continue the research in this area, in order to optimize results regarding the implementation and effectiveness of AAC in the population with MD and DB, taking into account the points mentioned above.

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