

Curricular integration of augmentative and alternative communication for students on the autism spectrum in inclusive-oriented schools: A scoping review

Autism
2025, Vol. 29(10) 2395–2411
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DOI: 10.1177/13623613251333834
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Abstract

Many students with autism spectrum condition who require augmentative and alternative communication systems attend inclusive-oriented schools, where it is expected that curricula support their preferred communication methods. While augmentative and alternative communication is recognized as an evidence-based practice, its integration within inclusive-oriented school curricula remains insufficiently understood. To address this gap, a scoping review was conducted in alignment with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, examining 34 studies on augmentative and alternative communication use in inclusive-oriented school settings for students with autism spectrum condition. The findings highlight limited teacher engagement, a variety of strategies, and an emphasis on communication skills, but leave a gap in understanding how inclusive-oriented schools employ augmentative and alternative communication to promote learning for autistic students. The review also addresses the restricted curricular integration of augmentative and alternative communication, noting that it is often implemented outside the classroom and primarily for social rather than academic purposes.

Lay Abstract

a. What is already known about the topic? It is well established that in inclusive-oriented schools, both the attitudes and training of teachers, as well as the accessibility of the learning environment, are crucial for the participation and success of individuals with autism. While practices like augmentative and alternative communication systems are used in these schools, their effectiveness is often contingent on the level of training and the time available to the professionals involved.

b. What does this paper add? This article highlights that augmentative communication for individuals with autism in inclusive-oriented schools is not effectively integrated into the curriculum. Instead, it is mainly used for brief socialization activities, without proper evaluation, and with limited involvement from teachers.

c. Implications for practice, research, or policy: The findings suggest the need for a more inclusive curriculum that incorporates augmentative and alternative communication systems, enabling them to be taught, assessed, and applied in a way that supports the learning of individuals with autism.

Plain Language Summary

This study examines how augmentative and alternative communication (AAC) systems are integrated into the curricula of inclusive-oriented schools for students with autism spectrum condition. Students with autism spectrum condition who use augmentative and alternative communication are increasingly attending inclusive-oriented schools, where a flexible curriculum to support their preferred means of communication is expected. However, few studies have examined

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the curricular integration of augmentative and alternative communication. In this review, which includes 34 studies on augmentative and alternative communication use in inclusive-oriented schools, we found limited teacher engagement with these tools and that, while there are varied strategies, they emphasize participation and communication skills over academic goals. This study highlights the need for better integration of augmentative and alternative communication into the curriculum so that students with autism spectrum condition can use augmentative and alternative communication for classroom learning.

Keywords

augmentative and alternative communication systems, autism, inclusive education, teaching

Introduction

Inclusive education is a transformative process within educational systems aimed at ensuring dignity and recognition of diversity (Echeita & Navarro, 2014). This is achieved through curricula that promote access, participation, and achievement for all students (Smucker, 2022) whether in specialized classes (Sweeney & Fitzgerald, 2023; Zakai-Maschiach, 2023), through Individualized Educational Programs (IEP) when students' levels do not align with those of their peers (Sabia et al., 2020), or in general classes for short or full school days (Carrera et al., 2024).

The curricular challenge for inclusion-oriented schools lies in determining whether students should adapt to the regular curriculum or whether an integrative curriculum is required to meet the diverse needs of students (Wehmeyer, 2024). Norwich (2010) argues that this curricular transformation must incorporate school principles, learning content, program objectives, and teaching practices. Universal Design for Learning (UDL; CAST, 2018) and collaborative efforts between general and special education staff (García-Melgar et al., 2022; Lee et al., 2010) contribute to this curricular transformation. However, evidence indicates that the primary responsibility for educating students with disabilities often falls on special education teams (Flood & Banks, 2021; Lory et al., 2024; Vinatea-Elorrieta et al., 2024).

In that sense, students with autism spectrum condition (ASC) tend to receive instruction in segregated spaces rather than in regular classrooms within inclusive-oriented schools (Kleinert et al., 2015; Maurer et al., 2024; Slee, 2018; Silc et al., 2024). For these students, educational offerings typically consist of a standard curriculum with accommodations. Thus, unresolved challenges lead schools that bring together students with and without ASC to adopt an inclusive orientation (Ozturk, 2024).

As a neurodevelopmental condition expressed in behavior, communication, and social interaction (American Psychiatric Association [APA], 2014) students with ASC face challenges in class participation, peer interaction, and adapting to routines (Little, 2017; Sutton et al., 2022; Schaeffer et al., 2023; Young et al., 2017). The shortage of specialists and insufficient teacher training hinder the learning processes of these students (Brock et al., 2020; Gray

et al., 2023; Pienaar & Dreyer, 2023; Rendoth et al., 2024; Rice et al., 2023).

The rise in ASC diagnoses (Maenner et al., 2023; Yáñez et al., 2021) has prompted the development of inclusive educational policies. However, these policies remain insufficient in addressing the complex adjustments needed by this population (Doda et al., 2024; Irarrázaval, 2023). Studies have shown that students with ASC often move from regular to special schools (Hasan, 2024; Stark et al., 2024; van den Helder et al., 2024), while learning outcomes do not necessarily differ between these contexts in terms of communication skills (Ilan et al., 2023), indicating that curricular issues for students with ASC in inclusive-oriented schools remain unresolved.

One evidence-based practice with students with ASC is the use of augmentative and alternative communication (AAC) systems (Chavers et al., 2021; Ganz, Davis et al., 2012; Ganz, Earles-Vollrath et al., 2012; Griffen et al., 2023; Lund et al., 2017; Sennott & Mason, 2016; Steinbrenner et al., 2020; Wandin et al., 2023). AAC enhances communication between the environment and individuals with ASC who communicate partially or differently from speech (Feerick et al., 2024). Defined as tools, devices, images, words, symbols, or gestures that compensate for expressive language challenges, with or without support (Maltese et al., 2018), AAC systems are not always generalized to school settings (Ganz et al., 2023). A lack of planning, training, and teachers' own communication skills hinders appropriate use in these environments (Bean et al., 2023; Biggs, 2022; Loi et al., 2023; May et al., 2025; Pereira et al., 2020; Vidal et al., 2020).

In special education settings and individualized environments such as therapy sessions, the use of picture exchange systems and speech-generating devices (SGDs) has demonstrated positive effects on learning and interaction (Fischbacher et al., 2024; May et al., 2025; Mishra, 2024). However, in mainstream schools, the selection of AAC systems has been more focused on speech rehabilitation, often overlooking other forms of communication (Zisk et al., 2024).

Teaching strategies for students with ASC include verbal prompts, increased wait time (Binger et al., 2011), reinforcement for specific behaviors, physical guidance,

modeling, verbal cues for initiating responses, incidental training based on student motivations (Blackwell & Stockall, 2021), chain interruption, and extinction to prevent reinforcing undesired behaviors (Casey & Carter, 2016). These strategies can be organized as Least-to-Most, progressing from simpler to more complex tasks; Most-to-Least, from complex to simpler tasks (Steinbrenner et al., 2020); or Show and Wait (Trembath et al., 2009), where something is shown, and time is given for a response.

When teachers incorporate communication skills into curricular design, ASC students' participation in regular classes improves (Tan & Perren, 2021; Xie et al., 2023). In this context, curricular integration, understood as aligning objectives and instructional methods in the design, implementation, and evaluation of learning (Azzarboni, 2005; Soto & Osorio, 2021), emerges as an opportunity to integrate AAC into the curriculum as more than just a strategy for instruction or behavior regulation (Ganz, 2015; Walker & Chung, 2022). Curricula can be integrated at four levels: the prescribed curriculum defined by policies, the institutional educational project that organizes its implementation, classroom planning by teachers, and individualized curricular adjustments to address student diversity (Álvarez, 2011).

For students with special needs, such as those with ASC, curricular coordination requires collaborative work with other professionals. Without this, regular teachers tend to make more intuitive decisions and apply practices unsystematically (Rendoth et al., 2024). Harmonizing curricular levels enhances learning, and understanding the integration of AAC within the curricular structure could better organize educational responses (Sánchez & García, 2022).

Other systematic reviews addressing AAC in inclusive-oriented schools for students with disabilities note that this area is still under-researched, focusing on peer interactions, social support, and academic engagement (Iacono et al., 2022). Strategies for integrating AAC in inclusive-oriented schools include training peers to support interaction with classmates with ASC, collaborative work to equip professionals to use AAC, modeling its use to students with ASC in natural contexts, and staff training in specialized techniques (Kleinert et al., 2023). Similarly, Lynam et al. (2024) highlight the need for further exploration of students with ASC' experiences in inclusive-oriented schools. These findings are significant as they describe the uses, facilitators, and barriers to AAC but do not yet clarify how AAC is integrated into inclusive school curricula for students with ASC.

Given the exploratory nature of AAC integration into inclusive school curricula, a scoping review was the most suitable method. Unlike systematic reviews, which synthesize findings from well-defined interventions (Owens, 2021), this review maps key concepts, assesses

research breadth, and identifies gaps (Levac et al., 2010; Peters et al., 2015). Since AAC curricular integration has not been systematically reviewed, this approach provides an overview of current practices, stakeholders, and barriers.

In this regard, this review will focus on (1) characterizing studies that address AAC instruction for students with ASC in inclusive-oriented schools; (2) the organization of AAC in schools serving these students, including who teaches or provides it, where it is taught, its frequency, and the content; (3) the strategies employed to teach AAC, including AAC type, teaching strategies, teaching stages, and activities; (4) how AAC is integrated into inclusive education curricula, specifying the curricular levels (educational project, teaching, and/or individualized curricular adjustments) at which it is incorporated.

Method

A five-step scoping review was conducted, which included developing a research question, identifying relevant studies, selecting studies, extracting data, and synthesizing results (Arksey & O'Malley, 2005).

Search strategy

Using the PCC framework (Population, Concept, Context), we defined the Population as school-aged students on the autism spectrum, the Concept as AAC systems, and the Context as inclusive-oriented schools. The inclusion criteria were established as follows: (1) use or reference to at least one AAC system; (2) a focus on students diagnosed with autism spectrum disorder; (3) empirical studies; (4) publication in English, French, Spanish, or Portuguese; and (5) an inclusive or inclusive-oriented school settings where students with and without ASC share common areas. Systematic reviews and clinical trials conducted in non-educational settings were excluded because they did not align with the focus of this review. Special schools' settings where students with and without autism do not interact are also excluded.

Following similar reviews (Iacono et al., 2022; Lynam et al., 2024) and with assistance from a university librarian, we conducted a search across multiple databases—Web of Science, SCOPUS, PubMed, SciELO, and EBSCO—from 2003 to 2024 in July 2024. Search terms were refined using the UNESCO Thesaurus, including (1) *autis**; (2) *“teaching methods”*; (3) *“communication”*; (4) *“augmentative and alternative communication”*; (5) *strategies*; (6) *inclusi**; (7) *AAC*; and (8) *learning*, combined with Boolean operators AND and OR. In addition, in January 2024, an additional search was conducted in the same databases and within the same date range, incorporating the concepts of *“Picture Exchange,” “SGD,”* and *“Sign Language.”* No language restrictions were applied.

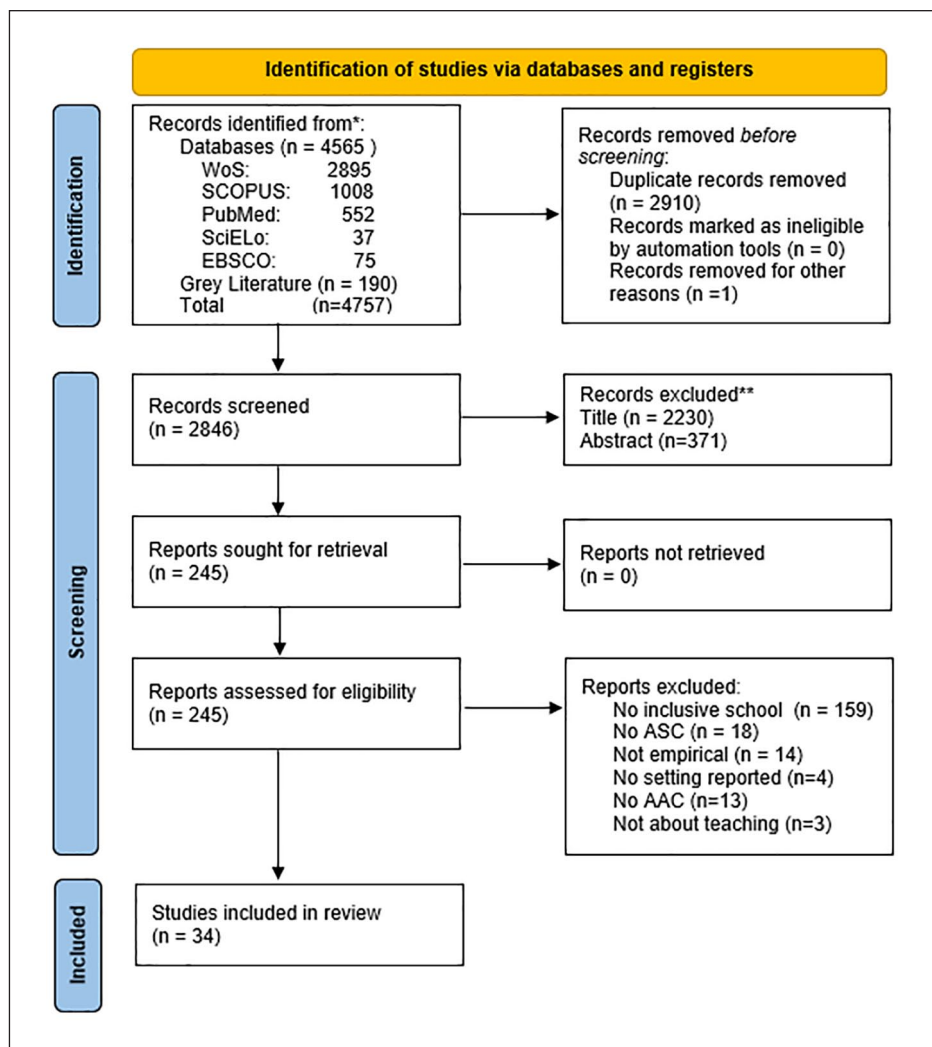


Figure 1. Search strategies and results flow diagram.

The search process followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for Systematic Reviews and Meta-Analyses (Tricco et al., 2018), and the protocol as well as supplementary material are available on OSF: <https://osf.io/cdrx7/>

Study selection

Search results were exported to Zotero, where duplicates and one retracted article were removed. Two researchers performed the screening, initially at the title level and then at the abstract level. A total of 245 articles were selected for full review. Interobserver agreement was assessed using Cohen's kappa coefficient (Landis & Koch, 1977), achieving a good agreement of 86.81% for the title screening and an almost perfect agreement of 96% for the full review. Discrepancies were resolved through discussion (see Figure 1 for PRISMA flow diagram).

Data extraction

An Excel spreadsheet was used to establish a list of variables. To report:

- Characterization of the studies, the following elements were included: study type, country, sample size, sex, and age range of the students.
- Organization of the instruction, the following elements were included: AAC interventionist or teacher (person who teaches or implements the use of AAC), teaching setting (classroom, separated room, other), teaching frequency (minutes, hours), content of teaching and activities (what is being learned?)
- Strategies, the following elements were included: AAC type, teaching strategies (modelling, prompts, molding, other), and teaching stages (least-to-most, show and wait, most-to-least).
- Curricular integration, curricular-level integration was included.

Direct quotations from discussions, conclusions, and projections were also included. Specific data on socioeconomic status were not recorded. Regarding ethnicity, these data are not included, as only 11 articles (32%) provided this information. Among the articles reporting ethnicity, nine are from the United States and one from Brazil. In this context, 54.5% of the students are White, 25% African American, and 18.2% correspond to students of Hispanic, Indian, Pacific Asian, or unspecified mixed origin living in the United States. In all, 2.3% represent a Hispanic student from Brazil.

Both authors extracted the data directly from the articles without interpretation. Interobserver agreement, calculated using Cohen's kappa for 5% of the articles, indicated an almost perfect agreement of 95%.

Data synthesis

Numerical data were collaboratively organized by both authors using frequency tables with percentages, while qualitative data were coded into categories following Saldaña (2013). Numerical and qualitative information was then triangulated to address the research questions. Quality assessments of the studies were not performed due to the limited number of available studies.

Autism representation

No individuals with autism or representatives from autism communities were involved in the design, data collection, analysis, or interpretation of this study.

Results

Study characteristics

Most studies on AAC use for teaching students with ASC in inclusive-oriented schools come from the United States (61.8%), followed by Europe and Oceania (20.6%) and other countries (17.6%), including Brazil, India, Taiwan, and Rwanda (see Figure 2).

Studies included a sample of 155 students with ASC, ranging in age from 2.11 to 18 years, with the majority falling between 2 and 5 years (see Table 1). The sample consisted of 91 males and 29 females, while one study did not report the sex of 35 participants (Gilroy et al., 2018).

Most studies employed a quantitative approach (74.2%), followed by qualitative (22.6%) and mixed methods (3.2%). These were categorized as either interventions involving students (76.4%) or descriptive studies (23.5%) that gathered perceptions on the use of AAC (see Table 2).

These demographic results suggest that the current understanding of AAC curricular integration in inclusive-oriented schools for students with ASC is primarily shaped

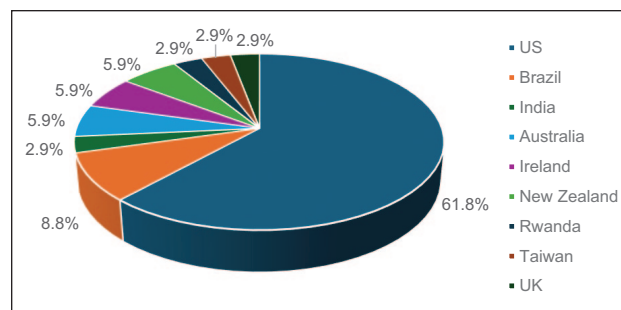


Figure 2. Distribution of studies by country.

Table 1. Sex and range of age of students with ASC.

Range of age (years)	Male	%	Female	%	Total	%
2–5	56	60.8	15	51.8	71	58.6
6–12	31	33.7	12	41.4	43	35.6
13–17	5	5.5	2	6.8	7	5.8
Total	92	100	29	100	121	100

by experiences from Northern Hemisphere policies (70.5%), with a Quantitative focus (73.5%). Studies focus on interventions with autistic boys (76%), who are mostly between 2 and 5 years old (60.8%).

AAC organization

Regarding who provides or teaches how to use AAC, of the 26 articles reporting interventions, 60% of the AAC interventionists were peers without ASC (Bourque & Goldstein, 2020; Chung & Douglas, 2015; Herbert et al., 2020; Hughes et al., 2013). Special Educators teachers, speech therapists, and paraprofessionals comprised 26.7% of the AAC interventionists (Andzik et al., 2016; Bourque & Goldstein, 2020; Chung & Douglas, 2015; Douglas et al., 2014; Johnson et al., 2004; Olive et al., 2007), while only 6.6% were teachers (Bourque & Goldstein, 2020; Carvalho & Nunes, 2014; Chung & Douglas, 2015; Johnston & Nelson, 2016); 5.78% refers to the researchers of the articles who conducted the AAC teaching process (see Table 3).

Regarding the content when using AAC and who teaches it, there is a tendency to focus on communication skills (38.2%) and on evaluating the perception of AAC use (20.5%). To a lesser extent, AAC is used for learning curricular skills related to learning objectives (5.8%) (see Table 4). Regarding the location of AAC instruction, 24 studies used regular classrooms (63.3%); 11 used separate classrooms, either special education rooms or offices (31.5%); and 2 used other spaces such as cafeterias (5.2%). In this instance, $n=38$ because in four studies, interventions occurred in more than one

Table 2. Characteristics of studies and sample in the articles.

Authors	Design	Approach	Type	Autism sample	Range of age	Sex
O'Donoghue et al. (2024) ^a	Qualitative iterative intervention design process	Qualit.	Descriptive	0	0	0
Gohsman and Johnson (2023)	Descriptive	Quant.	Descriptive	0	0	0
Martins et al. (2023)	Case study	Qualit.	Descriptive	0	0	0
Quinn et al. (2023)	Grounded theory	Qualit.	Descriptive	0	0	0
Young et al. (2023)	Descriptive case-study	Qualit.	Intervention	1	8,5	M: 1
Leatherman and Werner (2022)	N/I.	Qualit.	Descriptive	0	0	0
Srinivasan et al. (2022)	Quasi-experimental longitudinal study	Quant.	Intervention	17	6 R:3.5-12	M: 14; F: 3
Harper-Hill et al. (2021)	Mixed-methods nationwide survey	Mixed	Descriptive	0	0	0
Bourque and Goldstein. (2020)	Multiple baseline across children	Quant.	Intervention	6	4,4 R:3.8-4.11	M: 2; F: 4
Carnett et al. (2020)	Concurrent multiple baselines across participants	Quant.	Intervention	2	7,5 R:5-10	M: 2
Herbert et al. (2020)	Multiple probe across participants	Quant.	Intervention	2	17,5 R:17-18	M: 2
Wu et al. (2020)	Multiple baseline across participants	Quant.	Intervention	2	8 R:8-8	M: 2
Alzrayer et al. (2019)	Nonconcurrent multiple baselines across behaviors	Quant.	Intervention	2	8,5 R:7-10	M: 2
Carnett et al. (2019)	Multiple probe across participants	Quant.	Intervention	2	7,4	M: 2
Ntalindwa et al. (2019)	N/I.	Qualit.	Descriptive	0	0	0
Gilroy et al. (2018)	Pilot community-based randomized controlled trial	Quant.	Intervention	35	8,7 R: 5-13	N/I
Tan and Alant (2018)	A-B singled subject design	Quant.	Intervention	1	7	M: 1
Biggs et al. (2018)	Multiple-probe-across-participants	Quant.	Intervention	3	9,5 R:9-10	M: 1; F: 2
Thiemann-Bourque et al (2018)	Multivariate randomized control trial	Quant.	Intervention	45	3,5 R:2.11-5	M: 36; F: 9
Alzrayer et al. (2017)	Multiple probe across participants	Quant.	Intervention	3	9 R:8-10	M: 2; F: 1
Thiemann-Bourque et al. (2018)	Multiple probe across participants	Quant.	Intervention	3	4,6 R: 4.5-4.7	M:2 F: 1
Andzik et al. (2016)	Case example	Quant.	Descriptive	9	8,7 R:6-11	M: 4; F: 5
Johnston and Nelson (2016)	Case study	Qualit.	Intervention	1	4	M: 1
Togashi and Walter (2016)	Single-subject quasi-experimental	Quant.	Intervention	1	12	M:1
Chung and Douglas (2015)	Nonconcurrent multiple baseline	Quant.	Intervention	3	11 R:10-12	M: 2; F: 1
Carvalho and Nunes. (2014)	Quasi-experimental A-B	Quant.	Intervention	1	10	M: 1
Douglas et al. (2014)	Single-subject multiple probe	Quant.	Intervention	1	5	M: 1
Hughes, et al (2013)	Multiple baseline across participants	Quant.	Intervention	5	17 R:16-18	M: 4; F: 1
Tunney and Ryan. (2012)	Action research	Qualit.	Intervention	0	0	0
Ganz et al. (2010)	Multi-measure single case	Quant.	Intervention	1	3	M: 1
Trembath et al. (2009)	Multiple baseline	Quant.	Intervention	3	4 R:3-5	M: 3
Olive et al. (2007)	Multiple probe across participants	Quant.	Intervention	3	2,3 R:3.9-5.6	M: 3
Ganz and Simpson (2004)	Single-subject design within subjects	Quant.	Intervention	2	5 R:2-8	M: 1; F: 1
Johnson et al. (2004)	Multiple baseline across behaviors	Quant.	Intervention	1	8	F: 1

Quant.: quantitative; Qualit.: qualitative; N/I.: no information; R: range; M: male; F: female.

Table 3. Distribution of AAC interventionists and users according to study type.

Type	Person	Intervention	%	Descriptive	%	Total	%
AAC Int.	Peers	136	60.44	6	0.73	142	13.7
	Special Education Teachers	26	11.56	9	1.10	35	3.38
	Paraprofessionals	22	9.78	2	0.24	24	2.3
	General Teachers	15	6.67	171	20.88	186	17.8
	Researcher	13	5.78	0	0.00	13	1.3
	Speech-language therapist	11	4.89	533	65.08	544	52.5
	Others ^a	2	0.89	3	0.37	5	0.4
	Specialist ^b	0	0.00	81	9.89	81	7.7
	Policy Makers	0	0.00	3	0.37	3	0.2
	Families	0	0.00	9	1.10	9	0.7
	Autistic adult ^c	0	0.00	2	0.24	2	0.1
	Total	225	100	819	100	1034	100
AAC users	Students with ASC	155	100	0	0	155	100
	Total ^d	155	100	0	0	155	100

AAC Int. AAC interventionist, professional who facilitates and guides the use of AAC to enhance the student's communication.

Peers: Students without ASC; families of students with ASC.

^aPapers refer to volunteer adults in classroom, assistive technology or autism specialist, with no other information provided.

^bPaper refers to persons who review documents in the research.

^cPaper refers to allied health professionals with no specification, it may overlap with speech-language therapist.

^dTotals for AAC interventionists and AAC users are reported separately to avoid overlapping categories.

Table 4. Relationship between the content of teaching when using AAC and who teaches it.

Study type	Intervention								Descriptive								Total	%
Interventionist content of teaching	Reasercher	Staff	Teacher	PP.	SLP	ST	Peer	Reasercher	Staff	Teacher	PP.	SLP	ST	Peer				
Communication Skills	8	2	2	0	0	0	1	0	0	0	0	0	0	0	13	38.2		
AAC Perception	1	0	0	0	0	0	0	0	3	1	0	1	1	0	7	20.5		
PP. Skills	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	8.8		
Using AAC	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3	8.8		
Classroom Participation	1	1	2	0	0	0	0	0	0	0	0	0	0	0	4	11.7		
Peer Skills	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	5.8		
Curricular Skills	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2	5.8		
Total	14	5	4	3	0	0	1	0	3	2	0	1	1	0	34	100		
%	41.1	14.7	11.7	8.8	0.0	0.0	2.9	0.0	8.8	5.8	0.0	2.9	2.9	0.0	100			

PP.: paraprofessional; SLP: speech-language therapist; ST: special teacher.

location. Researchers were more likely to use separate classrooms, while school professionals tended to use regular classrooms (see Figure 3). Intervention or observation durations ranged from a minimum of 5 min to a maximum of 40 min (see Table 5).

Qualitative studies highlight the limited time professionals have for AAC preparation (Gohsman & Johnson, 2023; Leatherman & Werner, 2022; Quinn et al., 2023; Tunney & Ryan, 2012), which is a necessary condition for effective instruction (Iqbal et al., 2021). In addition, the

lack of AAC and ASC training (Gohsman & Johnson, 2023; Harper-Hill et al., 2021; O'Donoghue et al., 2024; Quinn et al., 2023) complicates collaboration among teams (Leatherman & Werner, 2022; Quinn et al., 2023).

Strategies for teaching AAC

The most frequently used strategies for teaching or use AAC were Prompts (22), Time Delay (21), Reinforcement (12), Physical Guidance (11), and Modeling (11).

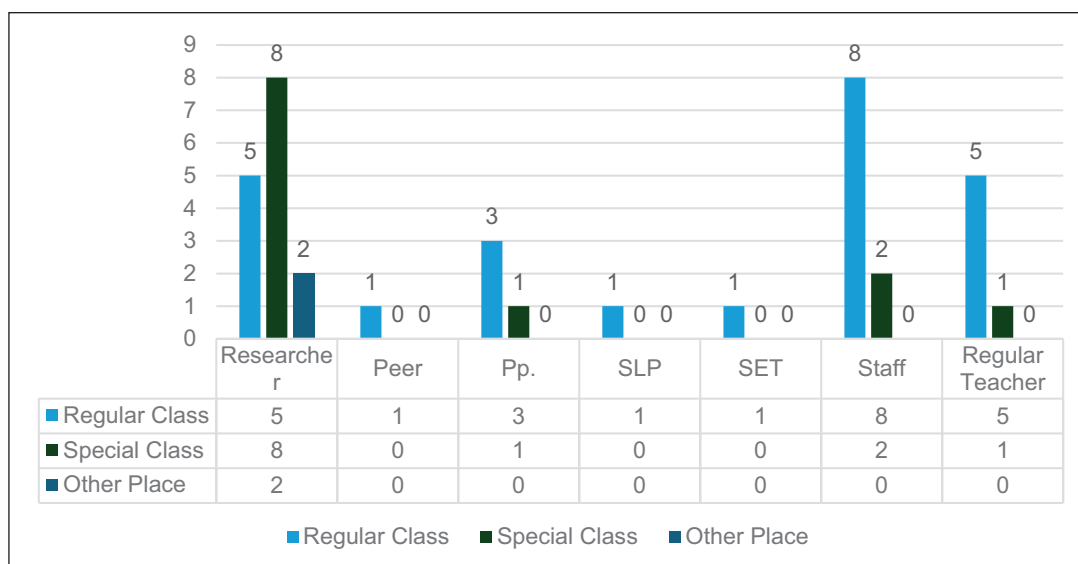


Figure 3. Settings where studies are focused on.
SET: Special Education Teacher; Other Place: Cafeteria, Lobby.

Incidental training or naturalistic teaching approaches were reported in four studies (see Figure 4).

These strategies were organized into four categories: Least-to-Most (gradually increasing assistance), Most-to-Least (gradually reducing assistance), Show-and-Wait (presenting or saying something and waiting for a response), and Other (focused on a single strategy or absent). In all, 41.1% used a Least-to-Most approach, beginning with verbal or gestural cues or instructions, escalating to modeling or molding and potentially including reinforcement; 23.5% used Show-and-Wait strategies, while 11.7% used Most-to-Least prompting, starting with modeling or molding and ending with cues or instructions. Regarding the activities, most observe students working one-on-one (26.4%) at different times of the day (26.4%) or in recreative spaces (17.6%) or in classroom (17.6%).

The majority of studies used aided AAC, SGD (64.7%), while the rest used picture exchange (20.5%) or referred to AAC in general (14.8%; see Table 5).

Curricular integration

Regarding curricular integration (see Table 6), studies tend to integrate AAC at the IEP level (41.1%), meaning personalized work with the student, with limited evidence regarding the integration of AAC into teaching or educational projects (8.8%). By contrast, while descriptive studies focus more on the needs of professionals and special education teachers for using AAC in teaching (62.5%), intervention studies focus on one-on-one activities (38.4%) or efforts to increase socialization (34.6%).

Qualitative information from the articles describes AAC implementation in inclusive-oriented settings as

obstructive due to factors such as distractions (Alzayer et al., 2017; Trembath et al., 2009), lack of curricular relevance (Wu et al., 2020), lack of collaboration (Martins et al., 2023), or limited resources (Ntalindwa et al., 2019). The study by Andzik et al. (2016) concluded that 80% of communicative events with AAC occurred outside the regular classroom, consistent with other studies in this review that took place in non-classroom settings (Bourque & Goldstein, 2020; Douglas et al., 2014; Herbert et al., 2020; Johnston & Nelson, 2016; Thiemann-Bourque et al., 2018; Trembath et al., 2009).

Discussion

This scoping review is the first to examine how AAC is integrated into inclusive school curricula for students with ASC. Evidence indicates that AAC is weakly embedded in curricula, with limited teacher involvement reflecting this gap.

Studies emphasize *Least-to-Most* and *Show-and-Wait* approaches, employing strategies such as prompts, reinforcement, time delays, and modeling to support AAC, peer interactions, and communication using SGD and picture exchange systems (Alzayer et al., 2017; Bourque & Goldstein, 2020; Gilroy et al., 2018; Srinivasan et al., 2022; Thiemann-Bourque et al., 2018). These findings align with research from special education or individualized settings (Fischbacher et al., 2024; May et al., 2025). However, caution is needed. Many studies focus on brief one-on-one AAC sessions (<30 min), conducted outside classrooms by non-teaching staff. In this sense, the lack of interaction between students with ASC or disabilities and their peers or teachers in inclusive-oriented schools has been

Table 5. Curricular aspects of AAC studies in inclusive-oriented schools.

Authors	AAC Int.	Setting	Frequency	AAC type	Teaching stages	Activities	Content	Curricular level
O'Donoghue et al., 2024	Staff	RC	Qualitative	General	No	General	AAC Perception	School Project
Gohsman & Johnson, 2023	SLP	RC	Qualitative	General	No	Different places	AAC Perception	No
Martins et al., 2023	Teacher	RC	N/I.	Pict.	Least to most	General	Curricular Skills	School Project
Quinn et al., 2023	Staff	RC	Qualitative	SGD	No	Different places	AAC Perception	Didactic
Young et al., 2023	Staff	RC	5–10 min	SGD	Show and wait	Tell a story	Participation	IEP
Leatherman & Werner, 2022	ST	RC	Qualitative	SGD	No	Different places	AAC Perception	Teaching
Srinivasan et al., 2022	Researcher	SC	20–30 min	SGD	Least to most	One-on-one	Com. Skills	No
Harper-Hill et al., 2021	Staff	RC/SC	N/I.	General	No	Different places	AAC Perception	No
Bourque & Goldstein, 2020	Staff	RC/SC	15 min	SGD	Least to most	Preschool games	Com. Skills	No
Carnett et al., 2020	Researcher	SC	5–10 min	SGD	Least to most	One-on-one	Com. Skills	No
Herbert et al., 2020	Researcher	OP	30 min	SGD	Least to most	Cafeteria	Com. Skills	IEP
Wu et al., 2020	Researcher	SC	40 min	SGD	Most to least	One-on-one	Curricular Skills	Learning
Alzrayer et al., 2019	Researcher	RC	20–25 min	SGD	Least to most	One-on-one	Com. Skills	IEP
Carnett et al., 2019	Researcher	SC	5 min	SGD	Least to most	One-on-one	AAC Perception	No
Ntalindwa et al., 2019	Teacher	RC	N/I.	SGD	No	Classroom	AAC Perception	School Project
Biggs et al., 2018	Researcher	OP	25–30 min	SGD	Show and wait	Lunch, Recess	Com. Skills	No
Gillroy et al., 2018	Researcher	SC	15 min	SGD, Pict.	Least to most	One-on-one	Com. Skills	No
Tan & Alant, 2018	Researcher	SC	5–13 min	SGD	Show and wait	Mathematics	Com. Skills	Materials
Thiemann-Bourque et al., 2018	Staff	RC	10 min	SGD	Least to most	Different places	Peer Skills	No
Alzrayer et al., 2017	Researcher	RC/SC	30 min	SGD	Least to most	One-on-one	Com. Skills	IEP
Thiemann-Bourque et al., 2018	Researcher	RC	6 min	SGD	Least to most	General	Com. Skills	No
Andzik et al., 2016	Staff	RC	5 min	SGD	Show and wait	Different places	Using AAC	IEP
Jogston and Nelson, 2016	Teacher	RC	N/I.	Pict.	Least to most	PlayTime	Participation	No
Togashi & Walter, 2016	Teacher	SC	12–21 min	Pict.	Least to most	One-on-one	Participation	Teaching
Chung & Douglas, 2015	PP	RC	15–20 min	SGD	Other	Classroom	PP Skills	IEP
Carvalho & Nunes, 2014	Teacher	RC	5–10 min	Pict.	Most to least	Classroom	Com. Skills	IEP
Douglas et al., 2013	PP	RC/SC	15 min	General	Show and wait	One-on-one	PP Skills	IEP
Hughes et al., 2013	Peer	RC	11 min	Pict.	Most to least	Different places	Com. Skills	No
Tunney & Ryan, 2012	PP	RC	Qualitative	SGD	No	Different places	PP Skills	Teaching
Ganz et al., 2010	Researcher	SC	5 min	Pict.	Show and wait	One-on-one	Using AAC	IEP
Trembath et al., 2009	Researcher	RC	10 min	SGD	Show and wait	Play & Mealtime	Peer Skills	No
Olive et al., 2007	Teacher	RC	5 min	SGD	Most to least	Free Play	Com. Skills	No
Ganz & Simpson, 2004	Researcher	RC	N/I.	Pict.	Least to most	Different places	Using AAC	IEP
Johnson et al., 2004	Staff	RC	10–15 min	SGD	Show and wait	Science activities	Com. Skills	IEP

RC: regular classroom; SC: special classroom; OP: other places; min: minutes; SGD: speech-generative device; AAC Int: AAC interventionist; Pict: picture exchange; Com. Skills: communicative skills; IEP: Individualized Educational Programs.

described, and it results in decreased academic engagement (Carter et al., 2024).

AAC is primarily provided by researchers, peers, and professional staff, while teachers—responsible for managing curricula and translating learning goals into instruction (Chevallard, 1998; Priestley et al., 2012)—play a limited role. This absence shifts AAC use toward communication rehabilitation rather than curricular engagement (Chung & Douglas, 2015; Gohsman & Johnson, 2023; Leatherman & Werner, 2022), reinforcing a medical-rehabilitation model (Lishuai et al., 2024; Slee, 2018).

Inclusive education must balance standardized curricula, which may not address student diversity, and personalized curricula, which can limit learning progression (Walker et al., 2018). While socialization and communication development are crucial for students with ASC, AAC implementation often aligns more with individualized plans than with classroom instruction. Given that 42% of studies fail to establish a curricular link, the absence of a general curriculum poses a barrier to AAC instruction (Leatherman & Werner, 2022; Quinn et al., 2023). As a result, IEPs serve as

the primary curricular framework, though they are used in only 35% of cases, primarily for sample characterization (Alzrayer et al., 2017; Alzrayer et al., 2019; Andzik et al., 2016; Carvalho & Nunes, 2014; Chung & Douglas, 2015; Ganz & Simpson, 2004; Herbert et al., 2020; Young et al., 2023). No studies report IEP contributions, but Tan and Alant (2018) noted their limited value, which is consistent with studies on IEPs that highlight their limitations in bringing students closer to curricular learning (Grimsby & Jones, 2024; Zagona et al., 2024).

Studies closer to general curricula suggest positive AAC outcomes. Tan and Alant (2018), Young et al. (2023), and Carvalho and Nunes (2014) found increased classroom participation when teachers incorporated AAC, while Johnson et al. (2004) demonstrated that AAC improved access to classroom activities. Teacher-led AAC instruction enhances participation, and peer modeling has been associated with increased AAC use and more interactive responses (Herbert et al., 2020; Thiemann-Bourque et al., 2018; Trembath et al., 2009). Therefore, the AAC curricular integration by teachers becomes relevant. Moreover, broader literature (Kacar & Gul, 2024; Tan and Alant, 2018; Tan & Perren, 2021) has shown that peers without ASC provide more flexible communication opportunities with extended wait times and reduced performance pressure.

In this sense, AAC for ASC students in inclusive education is primarily used to support participation rather than learning (Ainscow et al., 2006; Azorin & Ainscow, 2018). Curricular frameworks for ASC students prioritize social interaction over academic progress, leaving a gap in how AAC facilitates learning. Key aspects remain unclear, including the role of teachers, instructional design, the connection between prior knowledge and new learning, feedback mechanisms, and assessment strategies when using AAC with students with ASC.

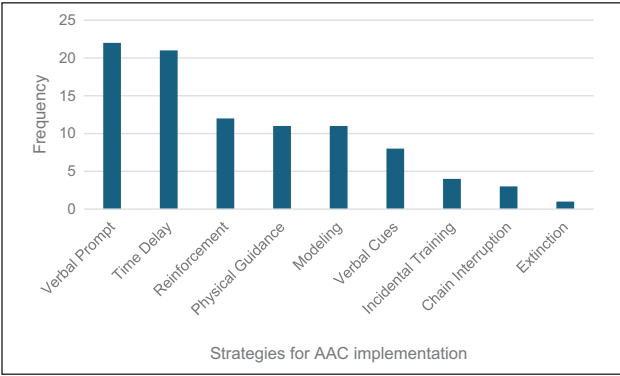


Figure 4. Frequency of strategies for AAC implementation.

Table 6. Curricular level and study type.

Study type	Activities	Curricular level									
		School Project	%	Teaching	%	IEP	%	No curriculum	%	Total	%
Intervention	One-on-one	0	0	2	50	4	40	4	33.3	10	38.4
	Journey	0	0	0	0	0	0	0	0	0	0
	Socialization	0	0	0	0	2	20	7	58.4	9	34.6
	Classroom	0	0	2	50	4	40	1	8.3	7	27
Total intervention studies		0	0	4	100	10	100	12	100	26	100
Descriptive	One-on-one	0	0	0	0	0	0	0	0	0	0
	Journey	1	33.3	0	0	1	100	1	50	3	37.5
	Socialization	0	0	0	0	0	0	0	0	0	0
	Classroom	2	66.7	2	100	0	0	1	50	5	62.5
Total descriptive studies		3	100	2	100	1	100	2	100	8	100
Total studies		3	8.8	6	17.6	11	32.3	14	41.1	34	

IEP: Individualized Educational Programs.

Although *Least-to-Most* and *Show-and-Wait* techniques enhance AAC effectiveness, classroom-based AAC instruction remains underdeveloped. While peer support fosters communication, little is known about how general education teachers use AAC for instructional purposes. This gap is critical, as evidence suggests that teacher and student with ASC interactions improve task engagement (Fasano et al., 2023; Losh & Blacher, 2023; Sparapani et al., 2023). Integrating AAC into lesson planning through UDL (CAST, 2018) and fostering professional collaboration (García-Melgar et al., 2022) may enhance its curricular role, mirroring the benefits observed in peer interactions.

Inclusive-oriented schools should align AAC with curricular learning, as with other educational resources (Norwich, 2010). However, limited collaboration (García-Melgar et al., 2022) and time constraints result in AAC responsibilities being transferred to special education teams (Lory et al., 2024; Vinatea-Elorrieta et al., 2024). This shift prioritizes rehabilitation and participation over curricular access, reducing learning opportunities for ASC students. While AAC supports communication and participation, evidence on its role in academic learning remains insufficient.

The focus of research in descriptive studies highlights the lack of knowledge, resources, and collaborative efforts in implementing AAC, mainly from the perspective of AAC interventionist (Harper-Hill et al., 2021; Martins et al., 2023; Ntalindwa et al., 2019). Intervention studies, by contrast, primarily address the communicative skills of students with ASC (Alzrayer et al., 2017; Carnett et al., 2020; Gilroy et al., 2018), although some also aim to enhance peers and paraprofessional skills in supporting communication (Chung & Douglas, 2015; Thiemann-Bourque et al., 2018; Tunney & Ryan, 2012). These findings highlight important opportunities for future research, including exploring the experiences of individuals with ASC who have used or learned to use AAC in inclusive-oriented schools, as well as examining interventions that focus on teachers' learning to use and teach AAC to their students.

Limitations

Most reviewed experiences are concentrated and represent to one country, limiting their representation or applicability to other regions like Latin America, Africa, or Asia.

Implications for research

Research on AAC in inclusive-oriented schools for students with ASC must expand globally to reflect diverse educational policies. In Latin America, where inclusive education is hindered by regulatory inconsistencies and resource gaps, this need is especially urgent (Alfaro, 2022; Gómez & Gobbeé, 2024). This aligns with Ntalindwa et al.

(2019), who highlighted the need for more research in resource-limited regions.

Participatory methods, such as action research, could investigate how teachers and teams make curricular decisions, examining not only participation but also learning outcomes using AAC in general classrooms. Curricular barriers in inclusive-oriented classrooms (Wu et al., 2020) and UDL are promising areas for study.

Future research should explore how participation can be systematically incorporated into the curriculum to enhance both participation and learning outcomes in inclusive-oriented settings. Further research is also needed on AAC's use across subjects like science, math, and the arts. Since inclusive-oriented schools often replicate special education models, future studies should explore what an inclusive AAC-based learning model might look like and how it compares to special education settings.

Future research should report students' ethnic backgrounds to provide insights into how educational interventions function across diverse populations. Transparency in reporting enhances the applicability of findings and supports inclusive education.

Implications for practice

Teachers, administrators, and curricular teams must integrate AAC into educational programs in collaboration with special education teams. AAC should align with state or national standards to ensure students with ASC in inclusive schools access appropriate content. Educational environments must address their communicative challenges (Douglas et al., 2022). Integrating AAC through UDL offers a promising approach (Ciurana & García, 2024).

This article calls for a systematic approach to AAC in curricula, beyond individual efforts or sporadic training. AAC should be sequenced with the same rigor as standard curricula, incorporating structured stages. In addition, research should capture the perspectives of both regular education teachers and students with ASC.

Author contributions

Jorge Eduardo Alfaro-Urrutia: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing—original draft, Writing—review & editing.

Pamela Pérez-Godoy: Investigation, Supervision, Writing—original draft, Writing—review & editing.

Data availability statement

Protocol, PRISMA-ScR Reported List, and variables summarized are available at <https://dx.doi.org/10.17605/OSF.IO/CDRX7>

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by Vicerrectoría de Investigación y Doctorados de la Universidad San Sebastián – Fondo USS-FIN-25-APCS-14.

Ethical approval

Ethical approval was not required, as this was a Scoping Review and did not involve working directly with living beings.

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Supplemental material

Supplementary material is available in <https://osf.io/cdrx7>

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