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Peer-Mediated Group Interventions to Improve Social Skills in Adolescents with Autism Spectrum Disorder and Comorbid Neurodevelopmental Conditions: A Scoping Review

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ABSTRACT

Background: Social skills are crucial for fostering positive peer relationships and social participation. Adolescents with neurodevelopmental disorders, particularly those with Autism Spectrum Disorder, but also with Attention Deficit Hyperactivity Disorder and Intellectual Disability, frequently struggle in this area.
Methods: This scoping review aims to identify evidence-based, peer-mediated group interventions designed to improve social skills in adolescents with Autism Spectrum Disorder, including those with comorbid neurodevelopmental conditions. Following PRISMA-ScR guidelines, we analyzed studies published between 2013 and 2024, focusing on early and middle adolescence (ages 11-16).
Results: The findings highlight that the vast majority of interventions target adolescents with Autism Spectrum Disorder, while research on ADHD, intellectual disabilities, or other neurodevelopmental disorders remains limited, and often includes cases of comorbidity or mixed diagnostic samples. Among the interventions, peer-mediated programs and structured cognitive-behavioral approaches, such as PEERS® and Social Skills Training, significantly improve social interactions and communication, and reduce maladaptive behaviors. However, most studies involve small, homogeneous samples, limiting the generalizability of the results.
Conclusions: Future research should expand the scope of social skills interventions to include a wide range of neurodevelopmental profiles. It seems also necessary to address gender differences, investigate the long-term effectiveness of the interventions, and increase accessibility to educational settings to promote social participation and autonomy among neurodivergent adolescents.

Keywords: *Social skills; Peer-mediated interventions; Neurodevelopmental disorders; Evidence-based practices; Adolescents; ADHD*

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Introduction

In the literature, the construct of social skills encompasses a multitude of definitions. The concept is variously interpreted across theoretical frameworks: some definitions focus on the outcomes of social interactions (e.g., peer acceptance), others emphasize specific behaviors that maximize reinforcement and minimize punishment (i.e., behavioral perspective), while others underline the importance of behaviors that are socially valid and contextually appropriate (i.e., social validity perspective). However, these conceptualizations share several core elements. Many authors agree in defining these skills as learned, socially acceptable behaviors that enable individuals to engage in various social activities competently (Akin-Little et al., 2017). Gresham and Elliott's (1984) definition of social skills as socially acceptable learned behaviors that enable a person to interact with others in ways that elicit positive responses and assist in avoiding negative responses is probably the most widely recognized operationalization used in social skills research over the past few decades.

This definition highlights how social skills are central to forming and maintaining positive personal relationships with family, friends, peers, and romantic partners (Capodieci et al., 2018). During adolescence, relationships with peers assume a central role: adolescents, in the progressive estrangement and disinvestment from parental figures, find in the peer group new points of reference with whom they can identify and experiment. Within this context, adolescents complete the pivotal developmental task of identity formation. Consequently, having the skills and opportunity to form meaningful friendship bonds is of paramount importance for the growth and development of adolescents (Corsano & Musetti, 2012).

Neurodevelopmental disorders are 'a group of conditions with onset in the developmental period [...] characterized by developmental deficits that produce impairments of personal, social, academic, or occupational functioning' (American Psychiatric Association, 2013, p. 35), and they persist throughout the lifespan. There are six neurodevelopmental disorders: intellectual disability (or intellectual developmental disorder); communication disorders; autism spectrum disorder (ASD); attention-deficit/hyperactivity disorder (ADHD); specific learning disorder; and motor disorders. The definition proposed in the DSM-5 (APA, 2013) is primarily medical and clinical, and it significantly differs from the concepts of neurodiversity and neurodivergence that have gained traction since 1998, thanks to the pioneering work of autistic sociologist Judy Singer. Singer coined the term "neurodiversity" to refer to the virtually infinite neuro-cognitive variability among humans: every person has a unique and irreplaceable

nervous system with a one-of-a-kind combination of abilities and needs (Singer, 1998). The concept of neurodiversity represents a shift from viewing the experiences and identities of individuals as pathological or deficient to recognizing them as expressions of diversity (Douglas et al., 2023). Neurodiversity is an umbrella term that frames various conditions (i.e., "disorders") as natural human variations rather than diseases. Closely linked to the concept of neurodiversity is the term "neurodivergence," which is the term used to describe when a person's brain processes, learns, and/or behaves differently from what is considered "typical" (Bennett & Gibb, 2022; Thapar, Cooper, & Rutter, 2017).

Communication skills, language, and social skills underlie human interactions. Some domains are affected, to varying degrees, by all neurodevelopmental disorders, influencing interactions with peers and forming meaningful relationships from childhood to adulthood. In attention deficit hyperactivity disorder (ADHD), for example, inattention reduces opportunities to learn social skills by observing the environment, whereas hyperactivity and impulsiveness contribute to enacting behaviors that may annoy peers (Dewey et al., 2023; Arnold et al., 2005). These behaviors also include some characteristics of the disorder, such as the inability to wait one's turn, not listening to others, and frequently interrupting them when they speak (Gomes et al., 2013). These characteristics fall under pragmatic language skills, which are also deficient in those related to presuppositions and narrative discourse, though they are not directly interpretable as symptoms of the disorder. Pragmatic language encompasses several verbal and nonverbal skills fundamental to social interactions, and deficits in this area appear to mediate the social difficulties of children with ADHD (Gomes et al., 2013). Difficulties in impulse regulation, such as talking excessively, interrupting others, and making inappropriate comments, persist from infancy to emerging adulthood and continue to affect social relationships over time (Lefler & Sacchetti, 2014). For individuals with autism spectrum disorder (ASD), specific features of this condition also contribute to difficulties in creating and maintaining peer relationships. These issues include challenges with nonverbal communication (e.g., lack of eye contact), atypical conversational styles, and restrictive and repetitive behavior patterns (Baertschi et al., 2023; Dewey et al., 2023). Some individuals experience impairments in verbal communication, including either the absence of language use or deficient pragmatic language, similar to what we can observe in ADHD. Pragmatic difficulties are also common among individuals with intellectual disabilities (ID). They may include challenges in developing conversation topics, appropriately initiating conversations, telling coherent narratives, repairing conversational breakdowns, engaging in contingent dialogue,

perseveration, and communicating clearly and unambiguously (Lee et al., 2017; Vascelli et al., 2023).

Moreover, the presence of comorbidity with multiple Neurodevelopmental Disorders tends to exacerbate social exclusion and reduce friendship opportunities due to the severity of symptoms and more significant social skills deficits (Minnes et al., 2010; Minnes et al., 2016). Importantly, the lack of participation in social activities and the presence of limited social networks may not correspond to a lack of desire to engage socially. Additionally, neurodivergent youths face an increased risk of bullying, peer victimization, and social rejection (Bebko et al., 2014; Becker et al., 2017; Blacher et al., 2022; Torres Cabo, 2022).

Given the central role of peer relationships in adolescent development, this review focuses explicitly on group-based and peer-mediated interventions for adolescents with ASD. Adolescence represents a critical developmental window in which peer interactions serve as the primary context for social learning, identity construction, and autonomy development (Capodieci et al., 2018; Frankel & Laugeson, 2010). These interventions provide ecologically valid settings where adolescents can practice and consolidate social competencies through reciprocal engagement, observation, feedback, and shared experiences with age-matched peers In contrast, although effective in other contexts or developmental stages, individual or parent-mediated interventions may not offer the same opportunities for direct social exchanges with peers.

The objective of the scoping review was, therefore, to identify and map the most recent evidence on group-based, peer-mediated interventions designed to enhance social skills in adolescents with ASD, as well as in those with ADHD or intellectual disability when included in mixed samples. Several authors agree that to foster these skills, targeted social interventions are necessary, as those focused solely on symptom management do not appear sufficient to improve to be effective in improving interpersonal functioning (Alahmari et al., 2025; Capodieci et al., 2018; Gong et al., 2024).

Method

We conducted a scoping review following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) extension for scoping reviews (PRISMA-ScR) (Tricco et al., 2018). We chose this methodology to map the current state of evidence on interventions aimed at improving social skills in neurodivergent adolescents and to identify research gaps in this field.

Inclusion and exclusion criteria

Searching and selecting articles in the literature took place within three databases (i.e., PsycINFO, Scopus, and Web of Science) by identifying the following inclusion and exclusion criteria:

- Year of publication: We included only original peer-reviewed research articles published in scientific journals between 2013 and 2024 to ensure the inclusion of recent studies on the most current developments in research on social skills interventions for neurodivergent middle adolescents. We therefore excluded studies published at different times.
- Language: We included articles written in English or Italian and excluded articles published in languages other than English or Italian.. Including studies from the Italian context allowed us to broaden the scope of the review and consider the adaptability and relevance of interventions across different socio-cultural settings.
- Article type: We included only original peer-reviewed research articles that presented original data and met the criteria of methodological transparency, replicability, and academic rigor. We excluded theoretical articles, systematic reviews, narrative reviews, books, and dissertations because they did not meet the requirement for original empirical data.
- Participants: Since the population of interest is in early or middle adolescence, we selected articles whose participants were adolescents between 11 and 16 years or whose average age fell within that range. The participants' gender did not influence the selection of articles. Another inclusion criterion was the presence of a diagnosis of Autism Spectrum Disorder (ASD), either as a single diagnosis or in comorbidity with other neurodevelopmental disorders such as ADHD or intellectual disability (ID). However, we excluded studies where participants presented comorbid psychiatric conditions unrelated to neurodevelopmental disorders (e.g., mood disorders, psychotic disorders). The focus of inclusion was therefore limited to neurodevelopmental profiles, with or without comorbidity between ASD, ADHD, and ID.
- Interventions: we considered eligible for this review only studies using behavioral or psychoeducational methodologies to improve social skills through group-based and peer-mediated interventions. We excluded individual interventions (i.e., those involving only therapist-adolescent interaction, without any peer participation at any stage); mentoring programs that involved young adults or mentors outside the age range of interest; parent-mediated interventions, that did not include peer involvement

Finally, we excluded pharmacological articles, including those that evaluated drug efficacy or withdrawal as part of the intervention.

Search and selection of the studies

The initial aim of this scoping review was to include interventions for a broad range of NDDs (e.g., ASD, ADHD, ID, communication disorders, motor disorders, and learning disorders). However, a preliminary exploration of the literature highlighted a significant predominance of studies focused on ASD, with limited research addressing ADHD or ID, and a lack of intervention studies for other NDDs in the middle adolescence group. We operationalized the search terms to ensure a systematic and sensitive identification of relevant literature. In the databases PsycINFO, Scopus, and Web of Science, we used the search string *autism* OR *autism spectrum disorder* OR *ASD* AND *adolescents* OR *adolescence* AND *socialization skills* OR *social interaction* OR *social skills* AND *cognitive behavioral intervention*. We chose this strategy based on the initial identification of ASD as the most frequently studied condition for social skills interventions in adolescence.

To broaden the scope and reduce the risk of excluding studies on other NDDs, we conducted a manual search using alternative keywords by replacing *autism* OR *autism spectrum disorder* OR *ASD* with *neurodevelopmental disorders*; *attention deficit hyperactivity disorder* OR *ADHD* OR *intellectual disability* OR *ID*. We adopted this approach after observing that broader search terms often still yielded ASD-dominated results or non-interventional studies. This strategy aimed to capture studies that involved ADHD, ID, or mixed NDD profiles, even if not explicitly tagged as such in database indexing. This manual search helped to identify additional articles that the primary automated search might have missed, particularly those including broader NDD profiles or comorbidities.

As shown in Figure 1, we initially identified 233 articles, of which six were through manual search; we then eliminated five as duplicates. Specific to databases, of the 227 articles identified in the first search, we selected six within PsycInfo, 121 in Scopus, and 100 in Web of Science. Following the title reading, we screened 75 articles. At this stage, by reading the abstracts, we excluded those studies that included a sample with an average age lower or higher than the average age of interest for this review and those that included the evaluation or discontinuation of drug therapies. We therefore evaluated 35 articles in full text for eligibility. Several considerations guided their inclusion or exclusion regarding the selection by full-text reading of the articles. First, at this stage, it was possible to apply the criteria related to the type of intervention used in the studies, so not all the studies were group-based and did not involve

peers. Second, at this point of selection, it was possible to gain a deeper understanding of the characteristics of the different studies and, consequently, more accurately apply the inclusion and exclusion parameters related to the participants. We excluded one study because it did not accurately describe the sample's demographic characteristics, explicitly stating that the participants were between 15 and 50 years old without providing an average age relative to adolescents. This lack made it impossible to ascertain whether the diagnosed participants fell within the age group of interest. At the end of the selection process, we included 21 articles in the review.

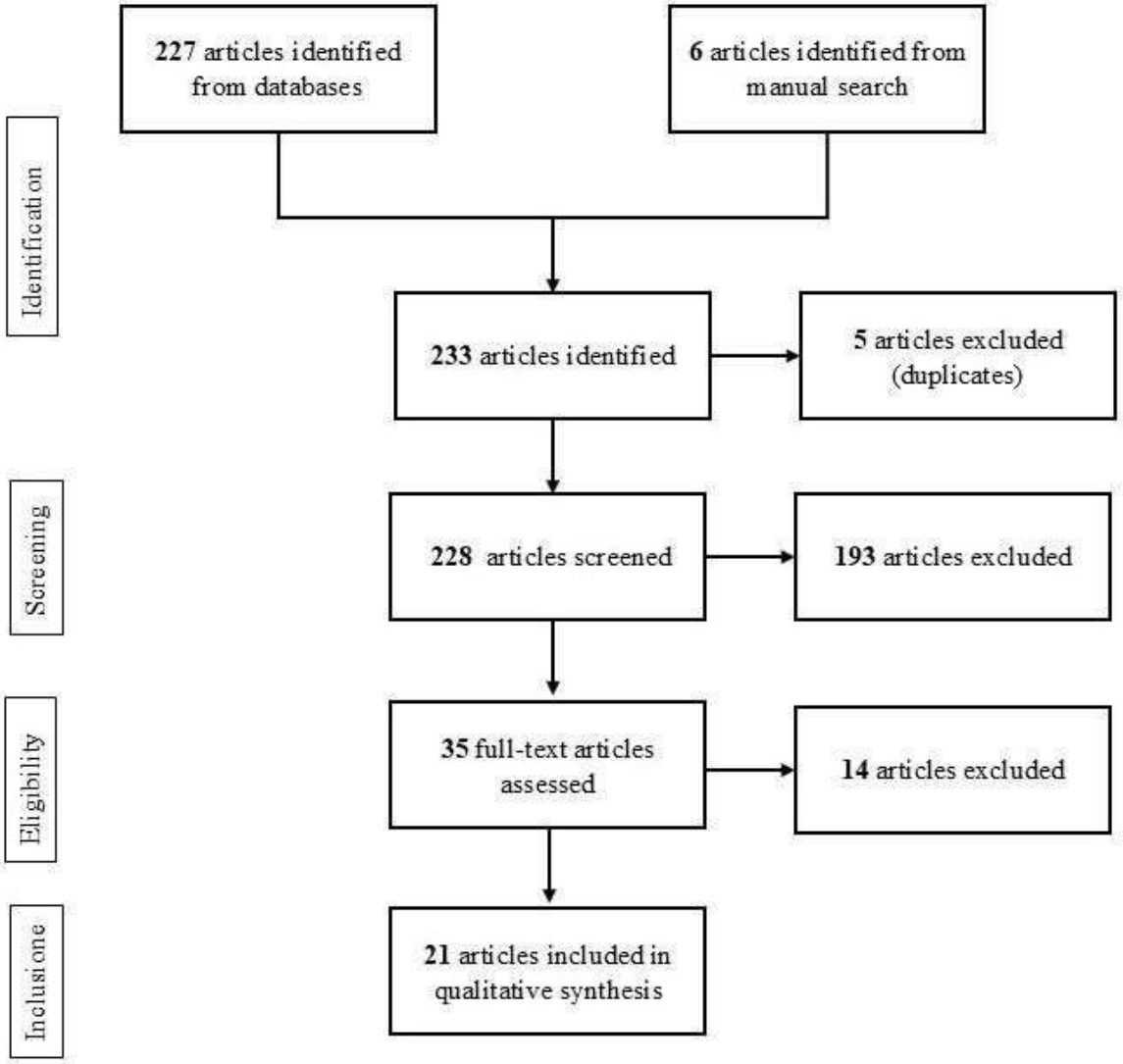

Figure 1 *- Selection process of articles present in the literature.*

Results

Population

In most of the selected studies, participants presented a diagnosis of ASD and no additional psychiatric disorders. Thirteen studies also applied IQ inclusion thresholds, typically requiring IQ higher than 70 (Albano et al., 2013; Akatsuka et al., 2020; Apinantanakul et al., 2021; Bai et al., 2023; Bambara et al., 2021; Bambara et al., 2022; Barrett et al., 2018; Carson et al., 2014; Corbett et al., 2023; Kim & Scahill, 2013; Ko et al., 2016; Ko et al., 2019; Laugeson et al., 2023; Maddox et al., 2017); one study (de Bildt et al., 2019) had an IQ higher than or equal to 80 (thus excluding from the sample even adolescents diagnosed with borderline intellectual functioning); one study had an IQ higher than or equal to 65 (Akin-Little et al., 2017). Gender distribution was often male-dominant; only one study focused specifically on adolescent ASD girls with ASD (Jamison & Schutter, 2017).

Types of intervention

The intervention most widely used in the literature is PEERS© (Program for the Education and Enrichment of Relational Skills) (Frankel & Laugeson, 2010). PEERS is a 90-minute manualized intervention with a duration of 16 weeks that involves activities conducted in small groups of adolescents and a parallel group for parents of social coaches. The activities include didactic lessons with illustrations of concrete rules and phases devoted to specific social skills, demonstrations through role-plays, exercises to test skills, and weekly ecologically sound socialization tasks. The group structure uses the principles of cognitive-behavioral therapy (CBT), such as psychoeducation, Socratic questioning, skill development and practice, cognitive strategies, and homework assignments. Topics discussed include conversation skills, sources of friendship, electronic communication, use of humor, sportsmanship, strategies for entering and exiting the conversation, organizing meetings with peers, conflict management, and dealing with rejection. Examples in typical adolescent situations demonstrate the rules and steps of social skills. Each session is devoted to ecologically mentally valid, creating, maintaining, and developing meaningful friendships. The application of this intervention showed that participants with ASD developed a deeper understanding of social skills and improved their communication and socialization. They engaged in more significant social interactions and interpersonal relationships (Akatsuka et al., 2020; Apinantanakul et al., 2021; Bai et al., 2023; Bahn et al., 2014).

Additionally, participants acquired more skills to establish friendships, leading to increased encounters with peers (Carson et al., 2014; Laugeson et al., 2023). In the area of clinical symptomatology, reductions have been observed in symptoms related to the disorder (Laugeson et al., 2023), including stereotypies and restrictive interests (Akatsuka et al., 2020; Bahn et al., 2014) and problem and maladaptive behaviors (Apinantanakul et al., 2021; Carson et al., 2014). In addition, the intervention was effective in reducing anxious states in mothers and depressive symptoms and emotional problems in adolescents (Bahn et al., 2014). Finally, improvements have been observed in social anxiety (Carson et al., 2014), self-esteem (Bai et al., 2023), and daily living skills (Apinantanakul et al., 2021). Baertschi et al. (2023), on the other hand, have shown how PEERS © is efficacious in improving skills and knowledge of social skills, responsiveness, and social involvement while also reducing behavioral problems in all three clinical groups they considered (i.e., adolescents with ASD, with ADHD, or both diagnoses).

Other methodologies in the literature are effective in improving rare social skills of adolescents with autism spectrum disorder by also observing secondary outcomes.

Some of these interventions (e.g., Social Skills Training and Social Skills Training with parents and teachers; Multimodal Anxiety and Social Skills Intervention; Social Tools And Rules for Teens) have similar methodologies. They consist of individual or group meetings in which different social skills are explained occasionally, role-play moments with other participants to practice these skills, and examples from movies, TV series, or everyday life experiences. The START program and the SST also involve homework assignments, their corrections, and discussions during weekly meetings with the involvement of parents and teachers in the SST-PTI. The application of these interventions found a general improvement in social skills (Barrett et al., 2018; de Bildt et al., 2019; Ko et al., 2016). In addition, participants at the end of the interventions showed less severity of symptoms and social vulnerabilities associated with the disorder (Barrett et al., 2018; Ko et al., 2016); increased socialization and cooperation skills (de Bildt et al., 2019); lower social difficulties and anxiety symptoms (Albano et al., 2013; Maddox et al.,2017); increased questions asked of the interlocutor and positive facial expressions directed at the partner during conversations (Ko et al., 2019).

Girls Night Out (GNO) results are increased social skills, improved quality of life, and reduced symptom internalizing (Jamison & Schutter, 2017). This program is a manualized intervention targeting girls with ASD, involving adolescents with typical development, lasting 12 to 16 weeks, and involves one session per week lasting two hours. The curriculum teaches social interactions and the skills needed for self-care. This intervention introduces several new

features compared to others. First, it takes place in social settings such as beauty salons or the home of one of the participants. Second, it explicitly targets girls, addressing the underdiagnosis of ASD in the female population and the lack of research in this area. This approach aims to help girls and young women build confidence and competence in social relationships by fostering positive female interactions in a safe and supportive space where they can learn new skills and challenge themselves. Female empowerment serves as the foundation of GNO. It promotes self-awareness and self-management in setting and monitoring achievable goals, finding common ground, and encouraging each other.

There are then some interventions in the literature aimed at improving the conversational skills of adolescents with ASD through both training and interaction with peers. In these interventions, the instructors provided either cards containing prompts to continue the conversation or explicit prompts at the beginning of each conversation session. The application of these interventions has been found in participants to increase in conversation skills interlocutor-centeredness with the use of more follow-up questions and comments (Bambara et al., 2021; Bambara et al., 2022) and an increased frequency of assertive acts during conversations (Ayad et al., 2016; Ayad et al., 2018). Improved skills and frequency in initiating conversations that are also longer have been observed (Ayad et al.,2016; Ayad et al., 2018). Researchers identified the SENSE Theater among the wide range of interventions for adolescents with ASD. This peer-mediated intervention uses behavioral strategies and engages children in preparing and staging a play to enhance their social competence. Corbett et al. (2023) demonstrated how this procedure effectively improved participants' vocal expressiveness and quality of peer relationships.

As mentioned at the beginning of this section, the existing literature focuses almost exclusively on ASD, paying less attention to other neurodevelopmental disorders. Within the databases, only one study targeted adolescents with intellectual disability (Alonso-Campuzano et al., 2023), and only one study involved participants with different diagnoses (Dean et al., 2020). The first study uses a storytelling-based intervention with three methodologies: traditional, digital, and tangible. The results showed how, independently of the type of storytelling used, participants presented good levels of collaboration and medium to low levels of prosocial behavior.

Finally, Dean et al. (2020) conducted a study involving adolescents with ASD, cognitive retardation, language difficulties, ADHD, conduct disorder, anxiety, an IQ of 76, and social difficulties without a diagnosis. The researchers divided the participants into two groups: one received an explicit intervention (i.e., Cognitive-Behavioral), while the other participated in an

implicit intervention (i.e., Imagine Create Belong) (Davidson et al., 2020). The results were different for the two groups:

- The "explicit intervention" group, consisting of five adolescents with ASD and one with delayed verbal and cognitive development, showed an improvement in social and emotional engagement, total social skills, and a decrease in flexible thinking.
- The "implicit intervention" group of the other six participants showed decreased scores related to perceived problem behaviors, internalizing and externalizing, improvements in narrative skills, and maintained cognitive flexibility.

This study highlights how the choice of intervention determines which social skills will be involved and, presumably, improved. It also suggests that social skills interventions can target a broader population, including all neurodevelopmental disorders.

Table 1. Characteristics of the articles included

Authors	Participants	Method	Intervention type	Setting	Duration	Results
Akatsuka et al. (2020)	N=28 and parents Age: 11-15 years (mean 13,08) Diagnosis: ASD QI > 70	Japanese version of PEERS ®	CBT	NA	14 weeks	Improvements in the areas of socialization, communication, knowledge of social skills, stereotypies and behavioral and emotional problems.
Albano et al. (2013)	N= 30 and parents Age: 12-17 years (mean 14,58) Diagnosis: ASD, suspected anxiety disorder QI ≥ 70	Multimodal Anxiety and Social Skills Intervention (MASSI)	CBT and applied behavior analysis	NA	14 weeks	Improvement in social difficulties and decrease in anxiety symptoms.
Alonso-Campuzano et al. (2023)	N= 14 Age: 11-17 years (mean 14,08) Diagnosis: mild or moderate intellectual disability, ASD, language difficulty.	Storytelling: tangible digital (TDST), digital (DST) and traditional (TST).	CBT	Classroom	NA	Positive effect of collaboration on student stories; good levels of cooperation and low to medium levels of prosocial behaviour.
Apinantanakul et al. (2021)	N= 12 and parents Age: 11-19 years (mean 14,8)	Thai version of PEERS*.	CBT	Hospital	10 weeks	Half of the parents have improved in the skills trained. Global improvement at the clinical level of the participants; in the scores

	Diagnosis: ASD, anxiety disorder QI ≥ 70					relating to: skills of daily living, socialization and communication. Decrease in maladaptive behaviors.
Ayad et al. (2016)	N= 3 Age: 14-15 years Diagnosis: ASD, FIL; global neurodevelopmental delay; ID	PMI (Peer-Mediated Intervention) focused on conversation	Peer-mediated	High school cafeteria	18 weeks	Improvement in the conversational skills of students with ASD; increase in: conversational acts, frequency of conversation initiation, follow-up questions and longer conversations; assertive acts.
Ayad et al. (2018)	N= 4 Age: 14-20 (mean 15,75) Diagnosis: ASD	PMI (Peer-Mediated Intervention) focused on conversation.	Peer-mediated	High school cafeteria	12/16 weeks	Increase in: conversation-initiation skills, follow-up questions, participation in conversation, and engagement in longer conversations; Total assertive acts for three of the participants, including the use of comments.
Baertschi et al. (2023)	N= 144 Age: 10-18 years (mean 13,9) Diagnosis: ASD (n= 60), ADHD (n= 43) or both (n= 41)	PEERS®	CBT	Outpatient clinic setting	16 weeks	Improvements in: social skills and knowledge about them; behavioral problems; social responsiveness; social involvement.
Bai et al. (2023	N= 33 and parents	Mandarin version of PEERS®	CBT	Classroom	14 weeks	Improvement in knowledge related to social skills. Increased self-

	Age: 12-17 years (mean 13,57) Diagnosis: ASD QI > 70					esteem and decreased social impairment scores.
Bambara et al. (2021)	N= 3 Age: 16-20 (mean 17,33) Diagnosis: ASD QI > 70	Conversation-centered peer-mediated intervention (PMI)	Peer-mediated	High school	Not explicitly stated	Increased use of partner-centric conversational skills.
Bambara et al. (2022)	N= 3 Age: 14-17 (mean 15,3) Diagnosis: ASD QI > 70; fluent in speech	Brief intervention based on conversation with peers, involves: explicit instructions; daily discussion sessions both at the beginning and at the end of the day; self-management	Peer-mediated	High school	Not explicitly stated	Increased partner-focused questions and comments.
Barrett et al. (2018)	N= 40 and parents Age: 12-17 years (mean 13.25) Diagnosis: ASD; QI > 70	Social Tools And Rules for Teens (START)	Psychoeducation	High school	20 weeks	Improvements in social functioning and reduction of social vulnerabilities associated with ASD.
Carson et al. (2014)	N= 58 and parents	PEERS®	CBT	NA	14 weeks	Improvements in knowledge about the concepts taught and skills to

	Age: 11-16 years (mean 13,65) Diagnosis: ASD QI ≥ 70					form friendships; in the number of meetings. Decrease in: levels of social anxiety; main symptoms of autism; problematic behaviors.
Corbett et al. (2023)	N= 207 Age:10-16 years (mean 12,62) Diagnosis: ASD QI ≥ 70	"SENSE Theatre"	Peer-mediated	School theatre	10 weeks	Greater salience of social stimuli which has a positive impact on vocal expressiveness and in the quality of the relationship with peers.
De Bildt et al. (2019)	N= 122 + parents and teachers Age: 9-13 years (mean 11) Diagnosis: ASD QI ≥ 80	Social Skills Training (SST) and Social Skills Training involving parents and teachers (SST–PTI)	Psychoeducation	School	15 weeks + 3 additional groups sessions, 2/6 months after	Improvements in socialization and cooperation scales; the SST-PTI group reports an increase in the frequency of social skills implementation at school.
Dean et al. (2020)	N= 12 Mean age: 12,8 Diagnosis: ASD, ADHDconduct disorder, anxiety and language difficulties; cognitive and language delay; QI = 76; social difficulties without diagnosis.	Implicit Group Intervention (Age-Appropriate Game-Based Group - PB) and Explicit Cognitive Behavioral Therapy (CBT) Group Intervention	CBT	School	8 weeks	CBT group improvements in: social engagement, social skills, emotional engagement, flexibility of thought. Group PB improvements in problem generation, precise vocabulary and use of symbols and in skills: narrative, sequencing events, initiating and creating a plot, understanding the roles of the characters and the general sense of

						the film. Maintenance of cognitive flexibility and decrease in social self-evaluation.
Jamison & Schutter (2017)	N = 34 Age:15-19 years (mean 15,97) Diagnosis: ASD	Girls Night Out (GNO)	Social learning theory (SLT), Behavioral theories (BT), CBT.	Everyday settings (home, school, shops, etc.)	12-16 weeks	Improvements in: perceived social competence; quality of life. Decrease in internalizing symptoms.
Ko et al. (2016)	N= 6 and parents Age:12-17 (mean 14,5) Diagnosis: ASD Language QI > 70	Social Tools And Rules for Teens (START)	Psychoeducation	NA	20 weeks	Improved social skills and decreased severity of ASD-related symptoms.
Ko et al. (2019)	N°= 35 and parents Age: 12-17 years (mean 13,51) Diagnosis: ASD Verbal QI≥70	Social Tools And Rules for Teens (START)	Psychoeducation	NA	20 weeks	Increased questions asked of the interlocutor and positive facial expressions directed at the partner in conversations.
Laugeson et al. (2022)	N= 29 and parents Age: 11-16 years (mean 14,45) Diagnosis: ASD QI > 70	Polish version of PEERS®	CBT	Partial online intervention due to COVID-19 restrictions	14 weeks	Increased knowledge of social skills and number of meetings with peers; decrease in the main symptoms of ASD.

Maddox et al. (2017)	N= 30 Age: 12-17 years (mean 14,42). Diagnosis: ASD, anxiety disorder QI ≥ 70	Multimodal Anxiety and Social Skills Intervention (MASSI)	CBT	University-affiliated clinic	15 weeks	Improvement in social difficulties, more significant in participants with high levels of social anxiety (with worsening in follow-up).

Discussion

This scoping review aimed to explore the existing literature to determine which evidence-supported interventions can strengthen social abilities in neurodivergent individuals in early or middle adolescence. We specifically focused on peer-mediated, group-based interventions, and included adolescents diagnosed with ASD as well as those with comorbid neurodevelopmental conditions such as ADHD and ID. While the reviewed evidence remains intensely focused on ASD, including studies involving mixed diagnostic samples, it allowed us to partially broaden the scope and reflect on the generalizability and applicability of these interventions beyond a single diagnostic category.

The studies analyzed showed the effectiveness of group interventions in enhancing different skills depending on the needs of the people they address. It seems possible to work both on socialization aspects in general and, in a more targeted way, on aspects related to conversation with peers. Coupling these interventions with those aimed at the symptomatology of the various disorders can produce effective improvement in adolescents' lives both by helping them relate to peers, also building meaningful relationships, and, as has been ascertained in some studies, by improving the characteristics of the disorder that can reduce well-being (Akatsuka et al., 2020; Bahn et al., 2014; Laugeson et al., 2023).

Building on these general outcomes, the following comparison highlights key differences in duration, setting, intervention type, and results across the various programs. Across interventions ranging from 8 to 20 weeks, cognitive-behavioral therapy (CBT) programs such as PEERS® and START typically span 14–20 weeks and are delivered in outpatient or naturalistic school settings, yielding robust gains in social skills, communication, and reductions in autism-related symptoms (Akatsuka et al., 2020; Barrett et al., 2018; Ko et al., 2019). Peer-mediated interventions, implemented in high-school cafeterias or theatre classrooms over 10–18 weeks, also foster conversational initiations, more extended dialogues, and greater social engagement among adolescents with ASD (Ayad et al., 2016; Corbett et al., 2023). Shorter game-based or storytelling approaches delivered within classrooms (8–12 weeks) produce moderate improvements in cooperation, narrative skills, and prosocial behaviour (Dean et al., 2020; Alonso-Campuzano et al., 2023). While CBT interventions require longer durations and formal clinic or school-based settings to achieve social and emotional gains, peer-mediated and play-based methods offer flexible, context-embedded alternatives yielding quick enhancements in specific conversational and cooperative skills.

Despite these encouraging findings, the current literature reveals substantial limitations regarding target population and intervention diversity.

The first obvious limitation of the existing literature concerns the little interest placed in implementing interventions aimed at enhancing competencies with adolescents with neurodevelopmental disorders other than ASD or in cases of comorbidity. Although our expanded search strategy allowed for the inclusion of studies involving ADHD, ID, and mixed NDD profiles (e.g., Baertschi et al., 2023; Dean et al., 2020), these remain markedly underrepresented. This gap underscores the need for future studies to include a broader range of NDD and assess whether existing programs are equally effective or need adaptation for different conditions and comorbid profiles.

Additionally, many of the selected studies presented low numerosity (Akatsuka et al., 2020; Albano et al., 2013; Alonso-Campuzano et al., 2023; Apinantanakul et al., 2021; Ayad et al., 2016; Bai et al., 2023; Bambara et al., 2021; Bambara et al., 2022; Dean et al., 2020) and representativeness of the selected sample. Most studies involved small, homogeneous groups, primarily white males (Baertschi et al., 2023; Carson et al., 2014; Corbett et al., 2023), excluding a considerable portion of the population. Given the growing recognition of gender-specific manifestations of NDDs and the underdiagnosis of females and nonbinary individuals, future research should include more diverse samples. This imbalance is due to the fact that most existing studies have predominantly included cisgender male participants, leading to a limited understanding of how gender-specific social profiles and challenges influence the effectiveness of interventions. Including underrepresented genders is essential to address social challenges linked to stereotypes, stigma, and cultural expectations that may further impact relational competence (Baertschi et al., 2023).

Methodologically, in one study on organizational issues, the sample was not randomized (Akatsuka et al., 2020). Several methodological limitations of the studies identified in the present scoping review limit the generalizability and robustness of findings. High dropout rates were reported in multiple studies, often linked to organizational challenges or external disruptions such as the COVID-19 pandemic, which in some cases led to necessary modifications of the intervention format during implementation (Corbett et al., 2023; Laugeson et al., 2022; Maddox et al., 2017). Moreover, the exclusion of participants with comorbid ASD and ID restricted the applicability of findings to the broader autistic population. As a result, it remains unclear whether the reported interventions are effective in more complex diagnostic profiles (Bahan et al., 2014; Bai et al., 2023; Carson et al., 2014; Corbett et al., 2023; Maddox et al., 2017). Limitations are also evident in the assessment procedures employed. Earlier studies often relied on a narrow range of tools to evaluate outcomes in ASD populations (Albano et al., 2013).

In some cases, parents or adolescents completed these assessments through self-reports without triangulation through external observers (Baertschi et al., 2023; Barrett et al., 2018; Dean et al., 2020). In other cases, caregivers or educators, who were directly involved in the intervention, provided the

assessments, potentially introducing informant bias and reducing the objectivity of the data (Akatsuka et al., 2020; Apinantanakul et al., 2021; Carson et al., 2014; de Bildt et al., 2019; Laugeson et al., 2023; Maddox et al., 2017). This heavy reliance on self- or parent-report measures raises concerns regarding data validity and cross-study comparability. Informant bias may result in under- or over-estimating the treatment effect due to subjective perceptions, social desirability, or expectations. Parent-reported improvements may reflect hope or perceived progress rather than the objective change. At the same time, adolescents may underreport difficulties due to the lack of insight or desire to present themselves favorably. Moreover, studies rarely addressed discrepancies between informants, even though multi-informant approaches could enhance triangulation and reliability. Future research should incorporate more observational, peer-based, or teacher-based assessments and strive to standardize measurement tools to increase comparability across studies.

Furthermore, the absence of control groups in several studies limits the ability to draw causal inferences or distinguish treatment effects from developmental changes over time (Bai et al., 2023; Ko et al., 2016). In some cases, there was no clear indication on whether participants were concurrently engaged in activities or other interventions that might have influenced the variables considered (Albano et al., 2013; Apinantanakul et al., 2021). Another recurring issue is the lack of follow-up evaluations, which prevents the assessment of long-term maintenance of social skills gains (Bai et al., 2023). In studies using direct observation, the potential for social desirability bias was evident, as participants may have modified their behavior due to awareness of being watched(Ko et al., 2019). Lastly, the limited duration of some interventions may have contributed to the absence of statistically significant results, highlighting the need for more sustained and intensive programming to achieve meaningful change (Albano et al., 2013).

Even the present review has limitations. First, the selection of articles in the databases may not have captured all relevant studies. Broader or alternative keyword strategies might have yielded more results, especially for underrepresented conditions or populations. Also, the limited time frame may have excluded earlier studies relevant to a broader conceptual understanding of social skills interventions for neurodivergent adolescents.

In light of the findings of the analysis of the existing literature, we can conclude that, given the increasing interest in social aspects in adolescence, it is fundamentally important to implement evidence-based interventions to improve the social skills of neurodivergent boys and girls. Our findings support the need for more inclusive and differentiated interventions, tailored not only to diagnostic profiles but also to cultural, gender, and developmental differences, that can be deployed in everyday settings (e.g., school). Implementing whole-class formats or inclusive group sessions could offer benefits that extend to all participants while fostering acceptance and reducing stigma.

Concrete strategies could be adopted to make future research more inclusive. These strategies may include target recruitment efforts to engage underrepresented groups through partnerships with schools, community centers, and advocacy organizations. Interventions should be culturally adapted so that language, context, and delivery reflect the values and experiences of the participants. Researchers should also systematically collect and report demographic data, including gender identity, ethnicity, and socioeconomic status, to promote transparency and equity in sampling.

Finally, the identified literature has not investigated the relationship between social skills and autonomy. It might be interesting to investigate whether and how the acquisition and reinforcement of social skills may benefit daily activities that require interaction with other people (e.g., making a reservation or asking for information).

Conclusion

This review highlights the theoretical, clinical, and practical relevance of peer-mediated, group-based interventions for enhancing social skills in neurodivergent adolescents. The findings suggest that such interventions can contribute to improved social competence, better emotional well-being, and greater autonomy. However, the review also reveals limitations in the current body of research, particularly regarding sample diversity, methodological rigor, and the inclusion of adolescents with comorbid neurodevelopmental conditions. To maximize the impact and equity of future interventions, it is important to adopt inclusive research designs that address gender identity, cultural background, and a broader range of neurodevelopmental profiles. Concrete strategies are necessary to enhance representativeness and applicability. From a methodological perspective, professionals should prioritize multi-informant assessments and standardized tools to ensure greater reliability and comparability across studies.

Finally, future research should explore the relationship between social competence and autonomy (e.g., the adolescent's ability to independently manage social situations, make decsions, and communicate effectively in contexts such as making a request, seeking help, or engaging in peer interactions) in everyday life. Investigating how the acquisition of social skills may support this type of practical functioning is a key direction for future studies.

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'Declarations of interest: none'.

Authors' contribution

All authors contributed to and have approved the final manuscript.

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