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Health Promotion and well –being intervention programs for adolescents and young adults with autism spectrum disorder

Agathi Stathopoulou * and Maria Christopoulou

Department of Public and Community, Health School of Public Health University of West Attica, Greece.

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Abstract

The present study investigates and evaluates health promotion and well-being intervention programs targeting adolescents and young adults with Autism Spectrum Disorder (ASD). The primary aim is to identify the specific deficits addressed by these programs, assess their effectiveness, and examine the generalizability of their outcomes based on established diagnostic criteria for ASD. The methodology employed was a systematic review of peer-reviewed scientific articles published between 2013 and 2024. The databases searched included PubMed and Scopus, and strict inclusion and exclusion criteria were applied. A total of 17 studies were selected based on relevance and adherence to these criteria. All included interventions were implemented with individuals aged 12 to 25 years, diagnosed with ASD and possessing an IQ ≥ 70. The review identified 10 core intervention programs, primarily targeting the enhancement of social skills, daily functioning, communication abilities, psychosexual education, and participant independence. Most programs reported statistically significant improvements in targeted skills, with several demonstrating sustained effects at follow-up assessments. This study highlights the critical role of targeted, evidence-based interventions for adolescents and young adults with ASD. It underscores the need for wider adoption of effective practices within educational and therapeutic settings, aiming to improve quality of life and foster the social inclusion of individuals on the autism spectrum.

Keywords: Autism spectrum disorder; Intervention; Program; social skills; Daily living skills; Life skills; Independent living; Adolescents; Teens; Young adults

1. Introduction

Autism Spectrum Disorder (ASD) is a multifaceted neurodevelopmental condition characterized by persistent difficulties in social communication and interaction, alongside restricted, repetitive patterns of behavior (1). In recent years, the rising prevalence of ASD and the distinct support needs of individuals on the spectrum have underscored the importance of designing and implementing targeted interventions aimed at enhancing their health and overall well-being (2). Particular focus has been placed on adolescents and young adults, as this developmental stage represents a pivotal period for fostering social inclusion, promoting autonomy, and facilitating the transition to adulthood (3). Health promotion, as conceptualized in contemporary public health discourse, extends beyond the mere absence of disease. It encompasses the active enhancement of individual functionality, autonomy, and quality of life (4-5). Within this framework, the imperative for tailored and inclusive interventions becomes evident—interventions that are responsive to the cognitive, emotional, and social specificities of individuals with ASD (6-7).

* Corresponding author: Agathi Stathopoulou

1.1. Health Promotion for Individuals with Special Educational Needs

The international literature highlights the increased challenges faced by individuals with special educational needs, particularly those with cognitive or developmental difficulties. Research indicates that this population is more susceptible to secondary health conditions, such as obesity, hypertension, and mental health disorders (8). The lack of specialized health professionals often results in the omission of essential interventions, such as physical activity programs, or nutritional guidance (9). Moreover, caregivers emphasize that promoting a healthy lifestyle should be a core responsibility for any professional working with individuals with special educational needs, given their daily and profound influence on these individuals' health and well-being (7). Health promotion is a fundamental right for all individuals, regardless of age, gender, social background, or cognitive status (4). Individuals with special educational needs encounter significant barriers in accessing health information, preventive care, education, and health services. In the context of neurodevelopmental disorders, particularly ASD, effective health promotion requires individualized and inclusive interventions that take into account the cognitive, social, and communicative characteristics of the population (6). Adolescents and young adults with ASD represent a subgroup with heightened support needs, especially in areas related to psychosocial well-being, stress management, life skills development, and social inclusion (3). Health promotion programs targeting this population must focus on enhancing functionality, empowering families, and fostering supportive environments to preserve mental health, autonomy, and quality of life (6-9). For individuals with special educational needs—and especially for students with neurodevelopmental conditions such as ASD—health promotion acquires significant value when it is aligned with initiatives aimed at improving social inclusion and psychosocial well-being (4). Recent studies have shown that social skills interventions implemented in naturalistic settings, such as schools, can positively impact participation, self-perception, and overall quality of life (3).In conclusion, promoting health among individuals with special educational needs, particularly adolescents and young adults with ASD, necessitates a coordinated approach that combines political commitment, institutional support, and the implementation of interventions integrated into their daily lives (10). School- and community-based initiatives are most effective when carried out through interdisciplinary collaboration and the active involvement of individuals and their families (11). Transitioning from a medicalized to an inclusive, community-oriented model focused on empowerment is essential for achieving meaningful well-being (12).

In conclusion, we highlight the importance of all digital technologies within education and ADHD training, which are not only highly effective but also enhance assessment, intervention, and educational processes through mobile devices that enable educational activities to be accessible anywhere [32-34]. Various applications of ICT are key enablers of education [35-40], along with AI, STEM, and ROBOTICS that elevate educational processes to new performance levels [41-46]. Furthermore, the development and incorporation of ICTs with theories and models related to metacognition, mindfulness, meditation, and the enhancement of emotional intelligence [47-62] significantly bolster educational practices and outcomes, particularly for minority children with ADHD, by addressing the domain and its practices such as assessment and intervention.

2. Methodology

2.1. Aim of our research

The aim of the present study is to provide a comprehensive review of current evidence concerning health and well-being promotion programs targeting adolescents and young adults with ASD. Specifically, the study explores: (a) the core autism-related deficits that the interventions address, (b) the effectiveness of these interventions, and (c) the potential for generalization of their outcomes to broader populations

2.2. Sources and Search Strategy

This study follows a systematic literature review methodology, drawing from peer-reviewed articles published in high-impact scientific journals. In the first stage, studies were identified and collected through electronic searches conducted in the Scopus and PubMed databases. The following search terms were employed: *"autism spectrum disorder" OR "autism" OR "ASD" AND "intervention" OR "program" OR "training" OR "trial" AND "social skills" OR "daily living skills" OR "life skills" OR "independent living" OR "communication" AND "adolescents" OR "teens" OR "young adults".*

2.3. Inclusion Criteria

- Experimental studies published between 2013 and 2024.
- Participants aged 12 to 25 years, with a formal ASD diagnosis and an IQ ≥ 70.
- Educational interventions conducted in clinical or academic settings.
- Programs targeting adolescents and young adults, with optional inclusion of parents or caregivers.

- Studies focusing on the development of social-emotional and adaptive functioning skills in individuals with ASD.

2.4. Exclusion Criteria

- Studies in which participants did not meet ASD diagnostic criteria or where cognitive functioning (IQ < 70) was not specified.
- Studies involving participants with comorbid neurodevelopmental or psychiatric disorders.
- Research that did not assess the effectiveness of the intervention or lacked a clearly defined methodology.

The selection process is presented in detail in the data extraction flow diagram

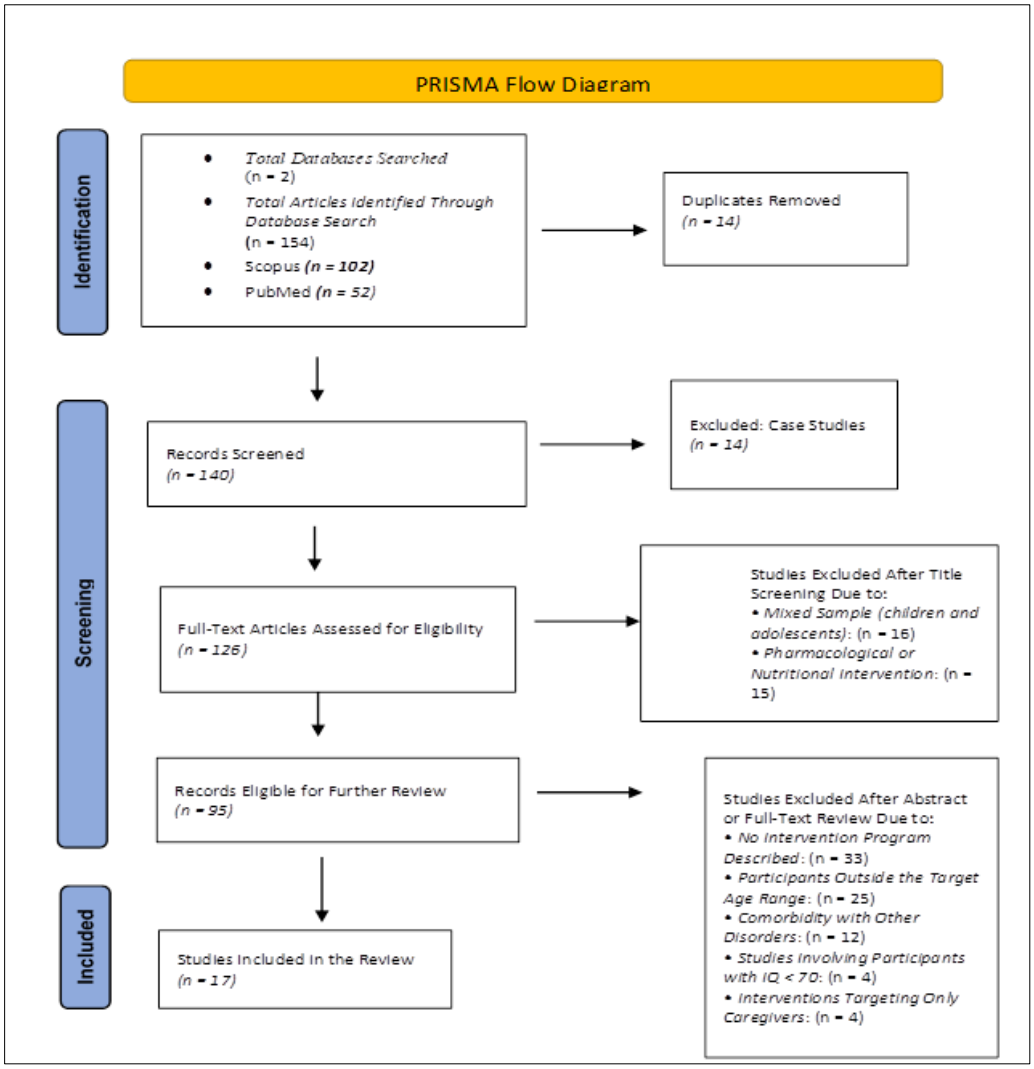

Figure 1 Prisma Flow Diagram for our review

3. Results

A total of 17 peer-reviewed studies were identified through a systematic review of the international literature (Table I), each evaluating the effectiveness of 10 structured interventions aimed at improving skills in adolescents and young adults with ASD.

The interventions most frequently cited across the identified studies include:

- Program for the Education and Enrichment of Relational Skills (PEERS) (13-14-15-16-17)
- Surviving and Thriving in the Real World (STRW) (18-19-20)

- Social Tools And Rules for Teens (START) (21-22)
- Adapted Cognitive Pragmatic Treatment (A-CPT) (23)
- Textual Prompts and Feedback (24)
- Collaborative Model for Promoting Competence and Success (COMPASS) (25)
- Conflict Orientation and Negotiation Training Among Children and Teens (CONTACT) (26)
- Tackling Teenage Training (TTT) (27)
- Virtual Reality–Social Communication Self-Training for Adolescents (VR-SAAFE) (28)
- Problem Solving Skills: 101 (PSS:101) (29)

These studies addressed a broad range of intervention goals. Most programs focused on enhancing social skills, such as social initiation, empathy, emotional expression, reciprocal interaction, and self-confidence (13-14-15-16-17-21-22). Other interventions aimed at improving daily living skills (18-19-20), strengthening communicative-pragmatic abilities (23), offering psychosexual education (27), or enhancing problem-solving and emotional regulation (29). Additionally, some programs focused on supporting the transition to adulthood (25), teaching conflict resolution skills (26), promoting the use of socially appropriate expressions of politeness (24), and leveraging virtual reality technologies to improve social communication (28).

3.1. Targeted Deficits in Intervention Programs

In addressing the first research question, the interventions identified were categorized according to the core deficits outlined in the DSM-5 for ASD. The findings indicate that the vast majority of interventions explicitly target improvements in social communication and interaction. In contrast, only one intervention was found to directly address restricted and repetitive behaviors. Nevertheless, almost all interventions appear to exert a positive—albeit indirect—impact on participants' overall functioning by fostering the development of social, emotional, and adaptive skills. The correspondence between each intervention and the core symptom domains of ASD is summarized in Table II. A detailed account of each intervention follows, highlighting the specific areas addressed, as defined by the DSM-5 diagnostic criteria.

Table 1 Mapping of Interventions to Core ASD Deficits

Intervention	Social-Emotional Reciprocity	Nonverbal Communication	Interpersonal Relationships	Restricted/Repetitive Behavior / Cognitive Flexibility	Functional Outcomes
PEERS	Direct	Direct	Direct	Indirect	Indirect
STRW	—	—	Indirect	Indirect	Direct
START	Direct	—	Direct	Indirect	Indirect
A-CPT	Direct	Direct	Direct	Indirect	Indirect
Textual Prompts	Direct	Indirect	Indirect	Indirect	Indirect
COMPASS	—	—	Indirect	Indirect	Direct
CONTACT	Direct	Indirect	Indirect	Indirect	Indirect
TTT	—	—	Direct	—	Indirect
VR-SAAFE	Direct	Indirect	—	Indirect	Indirect
PSS:101	—	—	—	Direct	Direct

- **PEERS:** The intervention directly targets core deficits in social communication and interaction, as defined in the DSM-5. Specifically, it focuses on enhancing socio-emotional reciprocity by training participants in initiating and maintaining conversations, expressing interest, and demonstrating empathy (13-14-15-16-17). It also promotes the understanding and appropriate use of nonverbal communication elements, such as body language, facial expressions, and tone of voice (14-16). Furthermore, the program strengthens skills related to the development and maintenance of interpersonal relationships, including friendships, romantic relationships, and conflict resolution (15).

- Additionally, the intervention indirectly addresses deficits associated with behavioral rigidity and the need for routines, as increased social engagement and participation in social activities have been shown to reduce reliance on repetitive behaviors (15-17). Overall, these processes contribute to the improvement of functional outcomes by enhancing social confidence, reducing social anxiety, and fostering participants' overall social integration (13-15-16-17). In the study by Idris et al. (2020), although indicators of psychological well-being were not directly assessed, an indirect improvement in functioning was observed through increased social engagement.
- **STRW:** The STRW intervention explicitly aims to enhance functional independence by addressing deficits that contribute to impairments in social, occupational, or other key areas of daily life. The strengthening of practical skills—such as self-care, money management, and community participation—combined with active parental involvement, has led to statistically significant and sustained improvements (18-19-20). The intervention also appears to have an indirect effect on social relationship deficits, as activities involving peer collaboration and joint planning (e.g., organizing a graduation party) foster initiative-taking and social adaptability (19). Additionally, it indirectly targets behavioral inflexibility, as repeated exposure to diverse everyday scenarios necessitates adaptive responses and the development of alternative strategies, leading to reductions in behavioral rigidity (18-20).
- **START:** The START program is primarily designed to address deficits in social reciprocity and the difficulties adolescents face in initiating and maintaining social relationships. More specifically, it promotes conversational initiation, active listening, and emotional exchange through experiential activities and guided application of skills supported by facilitators (21). Participation in structured group activities, interaction with peer role models, and systematic enhancement of social understanding significantly contribute to the development of interpersonal relationships (22). Moreover, START indirectly addresses deficits in behavioral flexibility by reducing social isolation and increasing social motivation (22). These changes ultimately lead to improved functional outcomes, as enhanced social skills and engagement facilitate greater inclusion and daily functioning (21-22).
- **A-CPT:** The A-CPT intervention directly targets deficits in social reciprocity, nonverbal communication, and interpersonal relationships. It specifically enhances the ability to infer communicative intent—such as recognizing sarcasm—thus strengthening emotional reciprocity. Systematic practice in the use and interpretation of nonverbal cues, such as facial expressions, vocal tone, and body language, addresses core impairments in decoding nonverbal communication. Additionally, the program emphasizes adapting communicative behaviors to fit different social contexts, thereby improving the capacity to develop and sustain interpersonal relationships. Although it does not directly address restricted or repetitive behaviors, A-CPT appears to reduce social isolation by promoting social engagement. Documented improvements in pragmatic communication skills and their maintenance post-intervention suggest an indirect enhancement of overall functioning through more effective communication and greater social inclusion in adolescents with ASD (23).
- **Textual Prompts and Feedback:** The intervention by Yamamoto and Isawa (2019) primarily targets deficits in socio-emotional reciprocity by training participants to use polite and socially appropriate expressions—such as "good morning," "thank you," and "please"—in professional and social interactions. These verbal skills facilitate conversation initiation and maintenance, promoting smoother and more natural social exchanges. The program also appears to secondarily improve nonverbal communication and contextual adaptation, as the use of such expressions is typically accompanied by appropriate vocal tone, eye contact, and facial expressions. Participation in a variety of social scenarios, in which participants are encouraged to flexibly apply social norms, may further enhance social adaptability and reduce behavioral rigidity. Finally, the observed improvements in participants' social integration and their adjustment to workplace environments suggest gains in functional outcomes (24).
- **COMPASS:** The COMPASS intervention (25) directly addresses functional deficits by fostering essential skills for independent living, vocational success, and broader social participation. Through the support of transition-related goals and the development of individualized strategies, adolescents gain greater independence and become more actively involved in society, mitigating the impact of functional impairments. The program also indirectly strengthens interpersonal skills by encouraging students to collaborate with peers and adults, participate in structured activities, and take social initiative—key components of successful social interaction and adaptation. Furthermore, its emphasis on flexibility and adaptability appears to indirectly address cognitive and behavioral inflexibility, particularly in relation to challenges with adapting to change. Improvements in self-regulation significantly contribute to reductions in rigidity, a common characteristic among individuals with ASD.
- **CONTACT:** The CONTACT intervention (26) primarily addresses social communication and interaction deficits. More specifically, it directly targets impairments in socio-emotional reciprocity by teaching negotiation and conflict resolution skills. Adolescents learn to express their opinions and emotions clearly and confidently, to recognize others' feelings, and to employ socially appropriate strategies for managing disagreements, thereby

enhancing the quality of their social interactions. The intervention also indirectly addresses nonverbal communication deficits through role-playing activities and the viewing of video scenarios that expose participants to facial expressions, vocal tones, and body postures. Additionally, the program strengthens interpersonal relationships by promoting social adaptation and peer collaboration in conflict situations. Although not a primary aim, the intervention seems to impact cognitive and behavioral flexibility, as participants are required to select alternative responses and apply varied conflict-resolution strategies, thereby reducing reliance on rigid behavioral patterns. Observed improvements in social adaptation, self-confidence, and interpersonal competence further suggest indirect gains in overall functional outcomes.

- **TTT:** The TTT program appears to directly and substantially address core deficits in social communication and interaction. Specifically, it targets socio-emotional reciprocity through activities focusing on emotional understanding, friendship, and romantic relationships. Simultaneously, it addresses nonverbal communication deficits via role-playing and systematic practice in decoding facial expressions, body posture, and tone of voice. The intervention also tackles interpersonal relationship difficulties by promoting the recognition and observance of personal and social boundaries—key components in forming and maintaining meaningful relationships. Indirect effects on behavioral flexibility are also noted, as scenario-switching and social simulations enhance participants' adaptability and reduce rigidity. Lastly, the intervention contributes to mitigating functional impairments associated with psychosocial and psychosexual development, facilitating adolescents' daily adaptation in critical areas of life (27).
- **VR-SAAFE:** The pilot study by Lahiri et al. (2015) primarily addresses socio-emotional reciprocity deficits through interactions with avatars, which help participants improve their ability to initiate and maintain conversations, express socially appropriate opinions, and respond to personal narratives. Nonverbal communication is indirectly strengthened through the use of the system's enhanced version (ES), which utilizes indicators such as gaze fixation, pupil dilation, and blink rate to support the decoding of nonverbal cues. Furthermore, dialogues based on personal interests and social scenarios help adolescents engage more effectively in social interactions, reducing social isolation and enhancing interpersonal relationships. The intervention also appears to indirectly impact behavioral flexibility, as participants are required to adapt their responses based on the unfolding conversation, thereby improving their capacity to navigate unpredictable social situations. Overall, the increased social engagement facilitated by VR-SAAFE contributes to improved functional outcomes, primarily through enhanced social participation and communicative adaptability.
- **PSS:101:** This program primarily targets deficits in socio-emotional reciprocity by strengthening problem-solving skills and the regulation of emotional distress during social interactions. Through the teaching of situational coping strategies, participants learn to better understand and manage their social responses, improving their ability to relate to others. Although not designed to directly address restricted or repetitive behaviors, its focus on cognitive flexibility and the use of alternative strategies indirectly contributes to reducing rigid thinking and improving adaptive functioning. Moreover, the intervention appears to indirectly enhance overall functioning by supporting autistic college students in managing stress, adapting more effectively to academic environments, and navigating daily challenges more successfully (29).

4. Analysis and Discussion

The growing awareness—both scientific and societal—of the needs of adolescents and young adults with ASD has, in recent years, led to the development of interventions aimed at improving their social functioning, communication, and autonomy. A review of recent literature reveals a noticeable increase in studies evaluating such interventions over the past five years, reflecting a heightened research interest in this population. Nevertheless, this age group—especially in comparison to children—often remains marginalized, despite being expected to meet increasing demands for social integration and functional independence. This underscores the pressing need for targeted, evidence-based, and developmentally appropriate interventions.

Notably, of the 17 studies included in this review, 12 focus exclusively on adolescents, three involve mixed-age samples (12–25 years) (23-24-25), and only two address young adults exclusively (15-29). This distribution clearly illustrates that while adolescent-focused interventions attract greater attention, early adulthood remains underexplored, despite involving critical life transitions and unique challenges for individuals with ASD. Similar conclusions are drawn by Taylor et al. (2012), who also emphasized the lack of evidence-based interventions for young adults with ASD. Despite encompassing a broader timespan (1980–2011), that review highlighted the predominant focus of existing studies on adolescents and the overall underrepresentation of young adults in research—an imbalance confirmed by the current review (30).

In terms of methodological design, the majority of the 17 reviewed studies employed quantitative methods, primarily focusing on the experimental validation of intervention effectiveness. Specifically, eleven studies used a randomized

controlled trial (RCT) design (13-15-16-17-19-20-21-22-25-26-27), including one pilot RCT (19), thereby enhancing the internal validity of their findings.

The remaining six studies, although not RCTs, were included due to their valuable contributions to understanding the effectiveness of interventions for adolescents and young adults with ASD. Three were pilot implementations (18-28-29) assessing the feasibility and preliminary efficacy of innovative (28-29) or adapted (18) interventions. For instance, Lahiri et al. (2015) provided promising initial evidence regarding the use of virtual reality technologies to enhance social skills in adolescents with ASD. Pugliese and White (2014) were among the first to adapt problem-solving therapy for college students with ASD—a notably underrepresented group in research. Duncan et al. (2017) evaluated a group intervention aimed at promoting daily living skills in high-functioning adolescents with ASD, addressing a critical gap in the literature related to transition readiness. Subsequent RCT trials (19-20) confirmed the effectiveness of this program, illustrating its gradual and systematic development in the field.

Similarly, Idris et al. (2020) conducted a non-randomized experimental study adapting and preliminarily evaluating the PEERS program in a different cultural setting (the Netherlands). Despite the lack of randomization and a control group, the use of standardized tools and pre-post assessments reinforces the significance of their findings for future RCT development. Gabbatore et al. (2022) employed a quasi-experimental design with assessments at three timepoints (pre, post, and 3-month follow-up) to evaluate a novel intervention targeting pragmatic-communicative skills in adolescents with ASD. Although no control group was included, the use of standardized measures and follow-up strengthened the methodological rigor of the study.

Yamamoto and Isawa (2019) adopted a staggered intervention design, where each participant was observed without intervention before receiving it at a later stage, to isolate the intervention effect from external factors. This study evaluated the efficacy of a targeted intervention utilizing textual prompts and feedback to enhance social expressions in adolescents and young adults with ASD. Despite the absence of a control group, the strict experimental protocol and systematic behavior tracking bolster the reliability of their findings.

Compared to Taylor et al. (2012)—in which most studies exhibited low methodological quality and a clear absence of RCTs—the current review highlights notable progress in research rigor. Most studies employed RCT designs, while even non-randomized studies utilized standardized tools, multiple assessment points, or strict experimental controls, enhancing the validity of the results and reflecting the field's methodological advancement.

A total of ten intervention programs were identified in this review, characterized by thematic diversity. Most aimed to improve social skills, functional communication, and autonomy, with a focus on interpersonal interaction, social understanding, and daily functioning. However, most interventions were conducted outside school settings—in university research centers (21-22-28), hospitals or specialized ASD centers (14-16-17-18-19-20-23-27), with only two conducted in schools (25-26), one delivered online (13), and one implemented in a public setting without specification (24).

Despite many adolescents being enrolled in schools, these interventions were not integrated into daily school life or curricula—a finding echoed in Taylor et al. (2012) and still relevant today. This is critical, as schools constitute primary settings for adolescent socialization. The absence of school-based programs underscores the need for future efforts to develop, implement, and evaluate school-integrated interventions. Strengthening social and functional skills within educational environments could significantly support inclusion and reduce social exclusion for adolescents with ASD. Integrating interventions into schools—through collaboration among educators, specialists, and parents—represents a promising yet underrepresented area in the literature.

Findings also revealed variability in how interventions addressed DSM-5 diagnostic criteria. While most targeted social communication, some also addressed other core deficits either directly or indirectly. In terms of the first research question, a consistent finding was that socio-emotional reciprocity was a primary intervention target. Programs such as PEERS, START, A-CPT, CONTACT, and VR-SAAFE explicitly aimed to enhance social initiative, emotional expression, and responsiveness to social expectations. This emphasis reflects the critical role of reciprocity in improving independence and quality of life.

Many interventions also addressed nonverbal communication, either directly (A-CPT, PEERS) or through experiential tools such as video modeling and social simulations (CONTACT, VR-SAAFE). Others promoted social politeness and compliance using textual prompts. Understanding facial expressions, gestures, and vocal tone was seen as vital for improving interaction. Additionally, the enhancement of interpersonal relationship skills was a key focus in many

interventions (e.g., PEERS, START, A-CPT, TTT), including fostering friendships, romantic relationships, and boundary-setting—highlighting the broader goal of social inclusion and reducing isolation.

In contrast, restricted and repetitive behaviors were less commonly targeted directly. Most interventions addressed these behaviors indirectly by encouraging flexibility, exposure to varied social contexts, and use of alternative strategies (e.g., STRW, CONTACT, VR-SAAFE, PSS:101). This likely reflects the complexity of modifying rigidity without inducing stress or dysregulation—a finding consistent with Taylor et al. (2012), where such goals were mainly addressed pharmacologically.

All reviewed interventions, whether directly or indirectly, aimed to promote functional outcomes. However, only three (STRW, COMPASS, PSS:101) explicitly targeted life skills, independent living, and stress reduction. Other programs (e.g., PEERS, A-CPT, CONTACT) reported indirect functional gains via increased confidence and real-life adaptability. This may stem from the assumption that improving social and communication deficits naturally enhances overall functioning—a multifaceted outcome requiring holistic, long-term support.

In relation to the second research question, this review assessed both the effectiveness and generalizability of the interventions. Results were encouraging, with most studies reporting statistically significant improvements in key social skills—such as initiating and maintaining conversations, recognizing and expressing emotions, and building interpersonal relationships. Programs such as PEERS, START, A-CPT, CONTACT, Textual Prompts, and VR-SAAFE demonstrated notable improvements in socio-emotional reciprocity and social engagement. These findings align with meta-analytic evidence supporting the effectiveness of interventions in enhancing social functioning and cognition in adolescents with ASD (31).

Psychological wellbeing also showed indirect improvements, such as reduced social anxiety and enhanced self-confidence, particularly in programs like PEERS and PSS:101—underscoring the multifaceted benefits of well-designed interventions.

Programs emphasizing functional empowerment (e.g., STRW, COMPASS, PSS:101) demonstrated meaningful improvements in autonomy, including daily living skills, money management, social participation, and life transitions (e.g., entering adulthood). Parental involvement also emerged as a critical success factor, especially in programs with practical training components.

Despite these promising results, questions remain regarding generalizability. Limitations such as heterogeneity in study designs, varied assessment tools, and lack of long-term follow-up hinder broad applicability. Most studies took place in controlled research or clinical settings, often with small samples and strict inclusion criteria—factors that, while enhancing internal validity, limit real-world generalization, especially in school environments.

Only one study (27), the TTT intervention, included a one-year follow-up. The rest assessed outcomes within a short timeframe (typically 3 to 6 months post-intervention), representing a significant methodological limitation. Without extended follow-up, it is difficult to determine whether acquired skills are sustained and integrated into daily life—an essential factor for genuine empowerment. Additionally, the cultural appropriateness of interventions has not been thoroughly examined. Most were developed and implemented in Western contexts (primarily the U.S. or Europe), limiting their transferability to other cultural and educational systems.

The lack of school-based implementation further challenges the ecological validity of these interventions. Since schools are central to adolescents' daily social experiences, failure to embed interventions into educational settings restricts opportunities for natural skill generalization.

5. Conclusion

This review highlights a gradual yet steady improvement in the design and implementation of interventions targeting social and functional skills in adolescents and young adults with ASD. In relation to the first research question, numerous programs were found to address—albeit to varying degrees—the core diagnostic features outlined in the DSM-5. Most focused on improving socio-emotional reciprocity, nonverbal communication, and interpersonal relationships, while restricted and repetitive behaviors received comparatively less attention. Functional empowerment was treated either as a direct goal (in a few studies) or as an indirect outcome of enhanced social functioning. The distribution of research attention across diagnostic domains underscores the need for holistic interventions that address the complexity of ASD-related challenges. Regarding the second research question, intervention effectiveness was generally encouraging—particularly concerning social skill improvement and psychological wellbeing. However, generalizability is limited by

small sample sizes, the lack of long-term follow-up, and the minimal integration of interventions into naturalistic environments such as schools. Additionally, the need for cultural adaptation remains largely unaddressed, limiting the broader applicability of these programs. Despite these limitations, the findings underscore the urgency of developing high-quality interventions with longitudinal follow-up, ecological validity, and cultural adaptability. Future research should focus on sustainable, inclusive, and contextually grounded approaches that promote genuine functional empowerment for adolescents and young adults with ASD.

Compliance with ethical standards

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Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

Statement of ethical approval

The Author had taken the approval of the appropriate committee of ethical and deontology on research.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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