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Effectiveness of a Peer-Mediated Intervention on Social Skills in Children with Autism Spectrum Disorder

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A B S T R A C T

The present study aimed to investigate the effectiveness of a peer-mediated intervention in improving social skills among children with autism spectrum disorder (ASD). This study employed a quasi-experimental design with pretest, posttest, a control group, and a two-month follow-up. The statistical population consisted of six-year-old children with autism spectrum disorder who attended a psychological center in Rasht, Iran, in 2026. From this population, 30 children were selected using convenience sampling and randomly assigned to an experimental group and a control group, with 15 participants in each group. The Social Responsiveness Scale, Second Edition (SRS-2), was used as the primary assessment instrument, while the Gilliam Autism Rating Scale, Third Edition (GARS-3), was employed for diagnostic screening and verification of eligibility criteria. The experimental group participated in 12 sessions of a peer-mediated intervention, each lasting 40 minutes, whereas the control group received no intervention. Data were analyzed using SPSS version 26, repeated-measures analysis of variance (ANOVA), and the Bonferroni post hoc test. The results indicated that Social Responsiveness Scale scores in the experimental group decreased from pretest to posttest, and this reduction was largely maintained at the two-month follow-up. In contrast, changes in the control group were limited. Furthermore, the difference between the experimental group's posttest and follow-up scores was not statistically significant. Peer-mediated intervention may be considered a supportive approach for reducing social responsiveness difficulties and enhancing opportunities for social interaction among children with autism spectrum disorder. However, further studies with larger samples and longer follow-up periods are needed to examine the durability and generalizability of its effects.

Keywords: *autism spectrum disorder, social responsiveness, peer-mediated intervention, social skills.*

1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent difficulties in social communication and social interaction across multiple contexts, together with restricted and repetitive patterns of behavior, interests, or activities. These characteristics emerge during the developmental period and may vary considerably in their form, severity, and functional consequences across individuals (American Psychiatric, 2022). Contemporary conceptualizations of ASD emphasize substantial heterogeneity in cognitive abilities, language development, adaptive functioning, sensory processing, behavioral regulation, and social participation, such that children with the same diagnostic classification may differ markedly in their everyday support needs (Lord et al., 2018). Clinical assessment and intervention therefore require attention not only to diagnostic symptoms but also to the child's functional performance within family, educational, and community environments. Early identification and appropriately targeted intervention are particularly important because social-communication difficulties may interfere with participation in developmentally important experiences, including cooperative play, classroom engagement, friendship formation, and reciprocal interaction with adults and peers (Hyman et al., 2020). Social functioning is consequently one of the central domains through which the developmental impact of ASD is manifested, and improving social participation has become a major objective of psychological, educational, and behavioral interventions for children on the autism spectrum.

Social functioning encompasses a broad set of interrelated capacities, including social awareness, recognition and interpretation of social cues, understanding of others' intentions and emotions, reciprocal communication, social motivation, behavioral flexibility, and the ability to initiate, maintain, and appropriately terminate interpersonal exchanges. Recent evidence indicates that autistic individuals may experience difficulties across several components of social functioning, although both the magnitude and expression of these difficulties vary considerably according to developmental level, context, task demands, and individual characteristics (Li et al., 2026). In childhood, these challenges can be especially consequential because social competence develops through repeated opportunities to observe others, practice interactive behaviors, receive feedback, negotiate shared activities, and adapt behavior to changing interpersonal demands. Peer interaction is therefore not merely an outcome of development but also an important developmental context through which social learning occurs. A systematic review of peer interactions among autistic children and adolescents has shown that differences may be observed in the frequency, quality, reciprocity, and maintenance of peer engagement, with implications for friendship development, social inclusion, and participation in everyday settings (Yardeni-Stern et al., 2026). When opportunities for reciprocal interaction are limited, children may have fewer occasions to practice and consolidate social behaviors, potentially contributing to a cycle in which reduced competence and reduced participation reinforce one another.

The importance of social skills extends beyond the diagnostic characteristics of ASD because the capacity to participate effectively in interpersonal environments contributes to emotional adjustment, educational functioning, independence, and quality of life. Social competence in early childhood is shaped through experience and can be influenced by the quality and nature of children's interactions with adults, peers, media, and structured learning environments. For example, developmental research has drawn attention to the potential association between children's patterns of digital-device use and their social development, highlighting the broader importance of providing young children with rich opportunities for direct interpersonal interaction (Dehghan Banadaki, 2024). Likewise, intervention studies in non-autistic child populations suggest that social-cognitive capacities can be strengthened when children are actively engaged in structured interpersonal learning. Storytelling-based intervention, for instance, has been associated with improvements in affective perspective taking and social problem solving among elementary-school children, underscoring the modifiability of social understanding through guided learning experiences (Ghasemi et al., 2024). Similarly, serious-game approaches have been used to facilitate attention, planning, organization, and social interaction in children with developmental and behavioral difficulties, indicating that developmentally engaging intervention formats can be valuable when they require active participation and reciprocal responding (MirHoseini et al., 2024). Broader systematic evidence also supports the usefulness of game-based interventions for promoting children's social skills when activities are structured around interaction, cooperation, turn-taking, communication, and shared goals (Kargar Khorami et al., 2026).

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For children with ASD, social-skills interventions have been developed using a wide range of theoretical and practical approaches, including direct instruction, modeling, role-play, behavioral rehearsal, video modeling, social narratives, group-based training, naturalistic developmental behavioral methods, cooperative activities, and peer-supported strategies. A recent systematic review and meta-analysis has supported the overall effectiveness of social-skills training interventions for children with ASD, while also indicating variability in outcomes according to intervention characteristics, study design, participant profile, and the social domains assessed (Alahmari et al., 2025). Such heterogeneity is clinically meaningful because improvement observed in a highly structured therapeutic situation does not necessarily translate into spontaneous social behavior in natural environments. A child may learn to answer questions, make requests, or recognize social cues during therapist-led sessions while continuing to experience difficulty initiating interaction with classmates or maintaining engagement during play. Accordingly, one of the major challenges in social intervention is not simply acquisition of an isolated behavior but its generalization across people, activities, and settings. Interventions that incorporate naturally occurring social partners may be especially relevant to this challenge because they provide opportunities for skills to be practiced under conditions more closely resembling children's everyday social lives.

Peer-mediated interventions are grounded in the premise that peers can serve as active agents of social learning rather than merely as passive interaction partners. In these interventions, typically developing or socially competent peers are taught or guided to initiate interaction, respond contingently, model appropriate social behavior, prompt participation, reinforce communication, and create opportunities for reciprocal engagement with a child with ASD. This approach differs from exclusively adult-directed intervention because the social contingencies are embedded within peer interaction itself, increasing the ecological validity of practice opportunities. Peer-mediated strategies can target a range of behaviors, including social initiation, response to others, conversational exchange, cooperative play, turn-taking, requesting, sharing, joint attention, and sustained engagement. Earlier reviews have indicated that peer-mediated social-interaction interventions can produce improvements in social communication and interaction for autistic students, particularly when intervention occurs within inclusive settings where peers are naturally available (Watkins et al., 2015). A systematic review specifically examining peer-mediated interventions for children with ASD likewise found generally favorable outcomes across social domains, although differences in implementation procedures and methodological quality suggested the need for continued rigorous research (Chang & Locke, 2016).

The developmental and educational value of peer-mediated approaches is especially apparent in early childhood and school settings, where peer relationships represent a major context for social participation. A systematic review focusing on preschool children with ASD in inclusive settings found that peer-mediated interventions were associated with improvements in several forms of social engagement and communication and highlighted the potential value of embedding intervention into naturally occurring classroom and play activities (Gunning et al., 2019). Similarly, a more recent systematic review of peer-mediated interventions for teaching social interaction to autistic individuals concluded that these approaches can facilitate meaningful improvements when peers are appropriately prepared, target behaviors are clearly defined, and opportunities for interaction are systematically arranged (Keuffer & de Souza, 2023). These findings are consistent with the broader emphasis on participation-based intervention, in which the success of treatment is judged not only by performance on isolated tasks but also by the child's ability to participate more successfully in socially meaningful situations. From this perspective, peers may function simultaneously as models, communication partners, sources of reinforcement, and bridges to social inclusion.

Randomized and controlled intervention studies have provided further support for peer-mediated strategies. Kasari et al. demonstrated that school-based interventions involving peers could improve social outcomes for children with ASD, reinforcing the importance of modifying the child's social ecology rather than focusing exclusively on individual skill instruction (Kasari et al., 2012). Kamps et al. subsequently evaluated a comprehensive peer-network intervention in kindergarten and first-grade settings and found improvements in social communication among children with ASD, supporting the feasibility of structured peer involvement during the early school years (Kamps et al., 2015). More recently, Zhang et al. conducted a randomized controlled trial examining the effectiveness of a peer-mediated intervention for children with ASD and reported beneficial effects on social skills, providing contemporary experimental support for peer-assisted social intervention (Zhang et al., 2022). Collectively, these studies suggest that peers can provide a powerful context for intervention

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because social skills are practiced within reciprocal exchanges rather than solely through adult explanation or therapist-directed rehearsal.

The mechanisms through which peer-mediated interventions may exert their effects are likely multidimensional. Social learning theory suggests that children can acquire new behaviors through observing models and experiencing the consequences associated with those behaviors. Within a peer-mediated context, children with ASD have repeated opportunities to observe age-appropriate interaction, imitate social responses, receive immediate reinforcement, and participate in reciprocal activities. Cooperative tasks can also create natural reasons to communicate, request assistance, share materials, take turns, and attend to others' actions. Moreover, when peers respond consistently to communicative attempts, they may increase the salience and functional value of social behavior. Repetition across varied activities may further support generalization by reducing dependence on a single therapist, prompt, or task. These features are particularly relevant because interventions that promote social inclusion must move beyond teaching discrete social behaviors and facilitate actual participation within peer groups. Contemporary systematic evidence concerning school-based interventions for autistic pupils emphasizes that social inclusion depends on environmental as well as individual factors and that intervention should address participation, relationships, and opportunities for belonging in mainstream educational contexts (Tsou et al., 2026).

A biopsychosocial perspective further strengthens the rationale for peer-mediated intervention. Under this framework, functional outcomes arise through the interaction of individual capacities, activities, participation, environmental supports, and contextual barriers rather than being explained solely by characteristics located within the child. A recent review examining peer-mediated social-skills interventions in primary-school settings through the International Classification of Functioning, Disability and Health framework emphasized the relevance of peer-based approaches for both social functioning and participation because peers themselves constitute an important component of the child's social environment (Ragaglia et al., 2026). Thus, an intervention may be effective not only because it changes the child's behavior but also because it modifies the interpersonal context by making social opportunities more accessible, predictable, and reinforcing. This distinction is important for children with ASD, whose difficulties may become more or less pronounced depending on whether environments provide comprehensible cues, supportive partners, sufficient processing time, and meaningful opportunities to participate.

Despite encouraging findings, several methodological and practical issues remain. Studies of peer-mediated intervention differ substantially in participant age, autism severity, intellectual and language abilities, intervention dosage, peer selection procedures, training methods, outcome measures, implementation settings, and follow-up duration. Some studies rely on direct behavioral observation, whereas others employ parent- or teacher-report instruments assessing broader social functioning. Intervention gains observed immediately after treatment may not always persist, making follow-up assessment essential for determining whether changes represent temporary treatment effects or more stable improvements. In addition, the cultural and educational context may influence the availability of peers, expectations regarding child interaction, parental participation, classroom structure, and the feasibility of implementing peer-mediated activities. Therefore, evidence generated in one setting cannot automatically be assumed to generalize to another. This issue is particularly important where peer-mediated interventions have received less empirical investigation and where locally implemented programs must be examined using standardized outcome measures and controlled designs.

The measurement of intervention outcomes also requires careful interpretation. Social Responsiveness Scale scores reflect the severity of social-communication difficulties and restricted or repetitive features associated with ASD, such that lower scores indicate fewer difficulties rather than lower competence. Consequently, an effective intervention is expected to produce reductions in problem-severity scores while simultaneously reflecting improved functional social responsiveness. This distinction is important when social skills are operationalized through instruments that assess impairment rather than directly counting adaptive behaviors. In the current literature, researchers increasingly recognize that meaningful evaluation should consider not only statistically significant changes but also whether improvements are sustained over time and are evident in domains relevant to everyday social participation. The focus on maintenance is especially important in young children, as social demands increase rapidly across developmental transitions and newly acquired skills must be flexible enough to support interactions with different partners and in different contexts.

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In Iran, there is also a need for additional controlled research examining structured social interventions for children with developmental disabilities using culturally appropriate procedures and psychometrically supported instruments. Existing Iranian research has demonstrated that structured psychosocial approaches can improve social functioning in different populations of children with developmental or educational needs. For example, solution-focused Kids' Skills and psychodrama have been investigated as approaches for improving social skills among educable students with intellectual disability, with evidence suggesting that social behavior can respond to systematic psychological intervention (Vatankhah et al., 2024). Such findings support the broader principle that children's social functioning can be strengthened through organized, participatory, and developmentally appropriate intervention. Nevertheless, social difficulties in ASD have distinctive characteristics, and peer-mediated methods specifically target reciprocal social exchanges that may be difficult to reproduce through adult-led treatment alone. Therefore, evaluating this approach within an Iranian clinical context can contribute evidence regarding its feasibility and effectiveness while also extending the existing international literature.

Taken together, current evidence indicates that social functioning represents a central challenge for many children with ASD, that peer relationships are an important context for both difficulty and developmental opportunity, and that structured peer-mediated interventions may enhance reciprocal interaction by combining modeling, reinforcement, cooperative activity, and naturally occurring social practice. At the same time, heterogeneity in intervention protocols, limited follow-up in some studies, contextual differences, and the need for replication in diverse cultural settings justify further controlled investigation. Interventions implemented during early childhood may be particularly valuable because they occur at a developmental stage when social routines, peer expectations, and patterns of participation are still being established, potentially allowing newly acquired skills to influence later social experience. Accordingly, systematic evaluation using pretest, posttest, a control group, and follow-up assessment can provide stronger evidence regarding not only whether social functioning improves after intervention but also whether those gains are maintained over time.

The present study aimed to investigate the effectiveness of a peer-mediated intervention on the social skills of six-year-old children with autism spectrum disorder and to examine the maintenance of its effects at a two-month follow-up.

2. Methods and Materials

2.1. Study Design and Participants

The present study was applied in purpose and employed a quasi-experimental design with pretest, posttest, a control group, and a two-month follow-up assessment. The statistical population consisted of children diagnosed with autism spectrum disorder (ASD) who attended a psychological clinic in Rasht, Iran, in 2026. The sample size was determined considering the quasi-experimental nature of the study and Cohen’s criteria for detecting a medium effect size of 0.50 with a statistical power of 0.85. Accordingly, 30 eligible children were recruited through convenience sampling and subsequently randomly assigned to either the experimental group or the control group, with 15 participants in each group. The inclusion criteria were a confirmed diagnosis of autism spectrum disorder based on a specialist clinical evaluation and documented diagnostic records, being 6 years of age, the ability to attend the intervention sessions regularly, sufficient readiness to participate in group-based activities, and written informed consent provided by a parent or legal guardian. Given the characteristics of peer-mediated intervention, the child also had to be able to participate in structured interactions with typically developing peers involved in the intervention activities. The exclusion criteria included voluntary withdrawal from the study, absence from the intervention sessions beyond the allowable limit established by the research protocol, and the occurrence of any physical, psychological, behavioral, or family-related condition that made continued participation impracticable. Before the intervention began, parents were informed about the objectives and procedures of the study, the voluntary nature of participation, their right to withdraw their child without adverse consequences, and the confidentiality of all participant information. Written informed consent was obtained from parents, and ethical principles governing research involving human participants, particularly the additional ethical considerations required when conducting research with children and children with neurodevelopmental disorders, were observed throughout all stages of the study. Following participant selection and random allocation, the pretest assessment of social functioning was administered to both groups. The

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experimental group subsequently received the peer-mediated intervention, whereas the control group received no intervention during the corresponding period. Immediately after completion of the intervention, both groups completed the posttest assessment, and the same outcome assessment was repeated two months later to examine the maintenance of intervention effects.

2.2. Measures

The Gilliam Autism Rating Scale, Third Edition (GARS-3), developed by Gilliam (2013), was used for diagnostic screening and verification of participants' eligibility for the study. The GARS-3 is designed to assist in identifying and evaluating behavioral characteristics associated with autism spectrum disorder in individuals aged 3 to 22 years. It consists of 56 items distributed across six subscales: Restricted/Repetitive Behaviors, Social Interaction, Social Communication, Emotional Responses, Cognitive Style, and Maladaptive Speech. Items are rated on a four-point scale reflecting the frequency with which each behavior is observed. Raw subscale scores are converted using normative tables into scaled scores, percentile ranks, and Autism Index scores, with higher scores indicating a greater frequency or severity of behavioral characteristics associated with ASD. Evidence supporting the validity of the original instrument has been obtained through analyses of its factorial structure, associations with established autism assessment measures, and its ability to discriminate individuals with ASD from comparison groups. Exploratory and confirmatory factor analyses have also supported the proposed subscale structure. Regarding diagnostic performance, the original version demonstrated sensitivity and specificity values of 0.97 and an area under the receiver operating characteristic curve of 0.93. Reliability has been investigated through internal consistency, test-retest reliability, and interrater agreement. Internal consistency coefficients exceeding 0.85 have been reported for the individual subscales and coefficients above 0.93 for the Autism Index scores. Test-retest coefficients were greater than 0.80 for the subscales and greater than 0.90 for the Autism Index scores, whereas intraclass correlation coefficients reflecting interrater agreement exceeded 0.80 for the subscales and 0.84 for the Autism Index scores (Gilliam, 2013). In Iran, Gorji et al. (2021) evaluated the diagnostic properties of the Persian version of the scale in a sample of 318 individuals comprising participants with ASD, individuals with hearing impairment, individuals with intellectual disability, and typically developing participants. They reported a sensitivity of 0.95, while specificity ranged from 0.52 to 0.90 depending on the comparison group, and overall diagnostic accuracy ranged from 0.76 to 0.93. The highest diagnostic accuracy, 0.93, was observed when the ASD group was compared with the typically developing group. In another study involving 113 individuals with ASD, Gorji et al. (2021) reported test-retest reliability coefficients greater than 0.86 and interrater agreement coefficients greater than 0.82. In the present study, the GARS-3 was used as a supplementary diagnostic and eligibility-screening instrument rather than as the primary outcome measure.

The Social Responsiveness Scale, Second Edition, Parent Form (SRS-2), developed by Constantino and Gruber (2012), was used as the primary outcome measure for assessing social responsiveness and autism-related social difficulties. The parent-report form is designed for children and adolescents aged 4 to 18 years and contains 65 items scored on a four-point Likert-type scale ranging from 0, indicating that the statement is never true, to 3, indicating that the statement is almost always true. The instrument assesses five domains of social functioning: Social Awareness, Social Cognition, Social Communication, Social Motivation, and Restricted Interests and Repetitive Behavior. Higher total and subscale scores indicate more pronounced difficulties in reciprocal social behavior and a greater severity of autism-related social impairment. Consequently, a reduction in SRS-2 scores following intervention reflects an improvement in social responsiveness and a reduction in the social difficulties assessed by the scale. Evidence for the validity of the original measure has been established through associations with widely used diagnostic instruments for autism. Reported correlations between SRS scores and Autism Diagnostic Interview-Revised scores have generally ranged from 0.60 to 0.77, whereas correlations with Autism Diagnostic Observation Schedule scores have ranged from approximately 0.15 to 0.58. The instrument has also demonstrated strong internal consistency, with Cronbach's alpha coefficients for the total score exceeding 0.93 in normative samples (Constantino & Gruber, 2012). Mirzakhani-Araghi et al. (2021) examined the psychometric properties of the Persian version of the SRS-2 among preschool- and school-aged children with autism spectrum disorder. Content validity was assessed by 10 specialists using the Content Validity Index and Content Validity Ratio, which were reported as 0.82 and 0.86, respectively. The Persian version also demonstrated satisfactory reliability,

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with a Cronbach's alpha coefficient of 0.93 for the total scale and an interrater intraclass correlation coefficient of 0.80. In the present study, internal consistency of the SRS-2 total score was assessed using Cronbach's alpha, which yielded a coefficient of 0.78, indicating an acceptable level of internal consistency for the study sample. The SRS-2 was administered at pretest, immediately after completion of the intervention, and at the two-month follow-up assessment.

2.3. Intervention

The peer-mediated intervention was developed to improve the social skills and reciprocal social engagement of children with autism spectrum disorder by drawing on the principles of behavioral modeling, cooperative learning, reciprocal teaching, social reinforcement, structured peer support, and positive feedback. The intervention protocol was informed by the peer-mediated intervention approach described by Zhang et al. (2022) and was adapted to the developmental characteristics and social functioning level of 6-year-old children with ASD. Before direct intervention sessions began, typically developing peers who participated as mediators received preparatory instruction regarding general characteristics of autism spectrum disorder, the purpose and boundaries of their role, respectful interaction, confidentiality, appropriate encouragement, and strategies for providing supportive rather than directive assistance. The experimental group then participated in 12 intervention sessions, each lasting approximately 40 minutes and conducted three times per week. Each session followed a consistent structure consisting of approximately 5 minutes of welcoming and preparation, 5 minutes of reviewing rules and modeling the target social behavior, 25 minutes of structured interactive activities, and 5 minutes of feedback, reinforcement, and session review. The initial session focused on establishing familiarity, introducing group members, explaining the rules governing joint activities, and modeling appropriate ways of initiating interaction. Subsequent sessions progressively targeted responding to social invitations, attending to conversational and activity turns, recognizing and responding to verbal and nonverbal social cues, initiating social contact, requesting participation, asking for assistance, inviting peers to engage in joint activities, and observing and practicing appropriate social behaviors through peer modeling. Other sessions emphasized turn-taking through structured games, use of visual or verbal prompts when necessary, participation in simple collaborative tasks organized around a shared goal, requesting and sharing materials, responding to peer requests, and cooperative learning activities in which group outcomes depended on coordinated participation. Later sessions focused on the provision and receipt of social support, encouragement and appreciation of peers, maintenance of interaction over time, responding appropriately to peer suggestions, re-engaging following interruptions in social interaction, and generalization of learned skills across different activities, materials, and peer partners. The final session reviewed the principal social skills taught throughout the program and incorporated a comprehensive cooperative activity requiring children to use multiple acquired skills simultaneously. Throughout the program, peers were encouraged to model target behaviors naturally, provide opportunities for the child with ASD to respond or initiate interaction, reinforce appropriate social behavior, and provide supportive feedback. The control group did not receive the peer-mediated intervention during the study period and continued with its routine activities. Following completion of the 12-session intervention, both experimental and control groups completed the posttest assessment, and a follow-up assessment was conducted two months later to evaluate the persistence of intervention-related changes.

2.4. Data Analysis

Data were analyzed using IBM SPSS Statistics version 26. Prior to inferential analyses, the dataset was examined for completeness, data-entry errors, outliers, and the statistical assumptions required for repeated-measures analysis. Descriptive statistics, including means and standard deviations, were calculated for SRS-2 scores at the pretest, posttest, and two-month follow-up assessments separately for the experimental and control groups. To evaluate changes in social responsiveness across time and determine whether the pattern of change differed between the experimental and control groups, repeated-measures analysis of variance was used, with time representing the within-subject factor and group representing the between-subject factor. The principal inferential evaluation therefore focused on the main effect of time, the main effect of group, and particularly the time-by-group interaction, which indicated whether changes across measurement occasions differed systematically between the two study conditions. Where statistically significant effects were identified, Bonferroni-adjusted pairwise comparisons were conducted to examine differences among pretest, posttest, and follow-

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up scores while controlling the familywise error rate associated with multiple comparisons. Particular attention was given to the comparison between posttest and two-month follow-up scores in the experimental group to determine whether the treatment effect was maintained after completion of the intervention. Statistical significance was evaluated at an alpha level of .05, and all analyses were conducted using two-tailed statistical tests.

3. Findings and Results

In this study, 30 six-year-old children with autism spectrum disorder were examined in two groups of 15 participants each: an experimental group and a control group. The mean age of the children was 6.20 ± 0.75 years in the experimental group and 6.35 ± 0.82 years in the control group. The two groups were homogeneous in terms of age and gender ($p > .05$). Other demographic variables were not included in the analyses because reliable data were unavailable. Table 1 presents the means and standard deviations for social skills and its components according to group membership and assessment phase (pretest, posttest, and follow-up).

Table 1

Descriptive Statistics for Social Skills and Its Components in the Experimental and Control Groups

Component/Variable	Group	Pretest, M ± SD	Posttest, M ± SD	Follow-up, M ± SD
Social Awareness	Experimental	11.20 ± 1.85	7.40 ± 1.30	7.60 ± 1.45
	Control	11.05 ± 1.65	10.90 ± 1.70	11.15 ± 1.60
Social Cognition	Experimental	14.30 ± 2.10	9.80 ± 1.55	10.10 ± 1.65
	Control	14.15 ± 1.80	14.00 ± 1.90	14.10 ± 1.85
Social Communication	Experimental	24.50 ± 3.20	17.20 ± 2.40	17.80 ± 2.60
	Control	24.20 ± 2.90	23.95 ± 2.80	24.10 ± 2.95
Social Motivation	Experimental	12.80 ± 1.90	8.90 ± 1.40	9.20 ± 1.50
	Control	12.70 ± 1.75	12.60 ± 1.80	12.75 ± 1.70
Restricted Interests and Repetitive Behavior	Experimental	19.70 ± 2.60	13.90 ± 2.10	14.30 ± 2.25
	Control	19.50 ± 2.40	19.60 ± 2.30	19.45 ± 2.35
Total Social Skills Score	Experimental	82.50 ± 9.40	57.70 ± 7.60	59.20 ± 8.10
	Control	81.60 ± 8.90	81.05 ± 8.60	81.40 ± 8.85

As shown in Table 1, the mean scores for social skills and its components decreased markedly in the experimental group at posttest and follow-up compared with pretest. These changes indicate that, in the experimental group, posttest scores decreased for Social Awareness, Social Cognition, Social Communication, Social Motivation, Restricted Interests and Repetitive Behavior, as well as for the total scale score. The results also indicate that scores for these variables in the control group showed no substantial changes from pretest to posttest or follow-up. Before conducting the inferential analyses, the normality of the total Social Responsiveness Scale scores was confirmed using the Shapiro–Wilk test at pretest ($p = .245$), posttest ($p = .312$), and follow-up ($p = .189$). The assumption of sphericity was also confirmed using Mauchly's test for the social skills variable ($p = .082$). Furthermore, Levene's test supported the homogeneity of error variances between the groups at pretest ($p = .415$), posttest ($p = .352$), and follow-up ($p = .288$). Overall, the assumptions of normality, sphericity, and homogeneity of variances required for repeated-measures analysis of variance were adequately satisfied.

Table 2

Results of Repeated-Measures Analysis of Variance for the Effectiveness of the Intervention on Social Skills

Source of Variation	Sum of Squares	df	Mean Square	F	p	η^2	Power
Within-subject effect (Time)	32.74	1.40	53.09	23.28	< .001	.45	.85
Between-subject effect (Group)	52.18	1	52.18	15.40	< .001	.35	.82
Interaction effect (Time × Group)	43.61	1.40	31.15	13.66	< .001	.33	.80

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As shown in Table 2, the main effect of time, F = 23.28, p < .001, the main effect of group, F = 15.40, p < .001, and the Time × Group interaction effect, F = 13.66, p < .001, were statistically significant for social skills. The significant Time × Group interaction indicates that the pattern of score changes across the different assessment phases (pretest, posttest, and follow-up) differed between the experimental and control groups, demonstrating that the intervention produced statistically significant changes.

Table 3

Bonferroni Pairwise Comparisons for Examining the Maintenance of the Intervention Effect on Social Skills

Variable	Assessment Phases	Mean Difference	SE	p
Social Skills	Pretest – Posttest	-24.80	1.45	< .001
	Pretest – Follow-up	-23.30	1.52	< .001
	Posttest – Follow-up	-1.50	1.20	.254

The Bonferroni pairwise comparisons across assessment phases in the experimental group showed that the mean differences in social skills scores between pretest and posttest (MD = -24.80, p < .001) and between pretest and follow-up (MD = -23.30, p < .001) were statistically significant. Given the scoring direction of the SRS-2, in which lower scores indicate fewer symptoms and better social functioning, the significant reduction in scores indicates a substantial improvement in social skills in the experimental group following the intervention. In addition, the difference between posttest and follow-up was not statistically significant (p > .05), indicating that the effects of the intervention were maintained at the follow-up assessment.

4. Discussion

The present study investigated the effectiveness of a peer-mediated intervention in improving social skills among six-year-old children with autism spectrum disorder and examined whether the effects were maintained over a two-month follow-up period. The findings showed that the experimental group demonstrated a substantial reduction in Social Responsiveness Scale, Second Edition (SRS-2) scores from pretest to posttest, whereas only minimal changes were observed in the control group. Because higher SRS-2 scores reflect greater social-communication difficulties and more pronounced autism-related social impairment, the observed reduction indicates an improvement in social responsiveness and functioning. The repeated-measures analysis further showed significant main effects of time and group, as well as a significant Time × Group interaction. This interaction is particularly important because it indicates that changes over the three assessment occasions were not attributable merely to the passage of time but differed systematically between the experimental and control groups. In addition, Bonferroni comparisons showed significant differences between pretest and posttest and between pretest and follow-up, whereas the difference between posttest and follow-up was not statistically significant. These results indicate that the peer-mediated intervention produced meaningful improvements and that these gains were largely maintained for at least two months following completion of the intervention.

The findings are consistent with the broader literature demonstrating that peer-mediated interventions can improve social functioning in children with autism spectrum disorder. Zhang et al. reported that peer-mediated intervention was effective in enhancing social skills among children with ASD in a randomized controlled trial, providing direct support for the pattern observed in the present study (Zhang et al., 2022). Similarly, Chang and Locke concluded in their systematic review that peer-mediated interventions generally produce favorable effects on social engagement, communication, and interaction in children with ASD, although the magnitude and durability of effects vary across intervention designs and settings (Chang & Locke, 2016). The present findings also align with the systematic review by Watkins et al., which showed that peer-mediated social interaction interventions can increase social initiations, responses, reciprocal exchanges, and sustained interaction among autistic students in inclusive contexts (Watkins et al., 2015). Collectively, these studies reinforce the view that peers can serve as effective intervention agents and that structured opportunities for peer interaction may facilitate the acquisition and consolidation of socially adaptive behaviors.

The improvement observed in the present study may be explained, in part, by the intervention's emphasis on repeated and developmentally meaningful social exchanges. Children

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in the experimental group practiced responding to social invitations, initiating interaction, requesting assistance, sharing materials, taking turns, participating in cooperative tasks, and maintaining interaction with peers. These behaviors represent core dimensions of everyday social functioning rather than isolated therapeutic exercises. Peer-mediated intervention may therefore be particularly effective because it places children in situations in which the target behaviors have immediate interpersonal consequences. A social initiation, for example, may lead directly to shared play, assistance, or access to a desired activity, thereby increasing the natural reinforcing value of social behavior. This interpretation is consistent with findings reported by Kamps et al., who demonstrated that comprehensive peer-network interventions can increase social communication in children with ASD during the early school years (Kamps et al., 2015). It is also consistent with Kasari et al., who found that interventions involving peers can improve social outcomes in school-aged children with ASD by altering the social environment and increasing opportunities for connection rather than relying exclusively on direct adult instruction (Kasari et al., 2012).

The present results may also reflect the importance of observational learning and behavioral modeling. During the intervention, peers modeled appropriate forms of communication, turn-taking, cooperation, encouragement, and response to social cues. For children with ASD, such concrete and repeated examples may make social expectations more observable and predictable. Rather than receiving only verbal explanations about appropriate social behavior, participants were exposed to social behaviors embedded in actual interpersonal interactions and were given opportunities to imitate and practice them. Keuffer and de Souza emphasized that peer-mediated interventions can support the acquisition of social interaction skills when target behaviors are clearly structured and peers are trained to provide appropriate models, prompts, and reinforcement (Keuffer & de Souza, 2023). Similarly, Gunning et al. concluded that peer-mediated interventions in preschool inclusive settings can improve social engagement and communication by embedding instruction within naturally occurring play and interaction (Gunning et al., 2019). Thus, the structured yet socially natural format of the present intervention may have supported learning by connecting behavioral rehearsal with real-time peer responses.

The pattern of changes across the individual SRS-2 domains further supports this interpretation. The experimental group showed lower scores at posttest and follow-up in Social Awareness, Social Cognition, Social Communication, Social Motivation, and Restricted Interests and Repetitive Behavior. Although the statistical analyses in the present study focused primarily on the total score, the descriptive pattern suggests improvement across multiple aspects of social functioning rather than in only one narrowly defined behavior. Social awareness and social cognition involve recognizing and interpreting social information, while social communication and social motivation concern the ability and willingness to engage reciprocally with others. Improvement across these domains is plausible when intervention repeatedly exposes children to predictable peer cues, reciprocal interaction, and opportunities for successful social participation. A recent systematic review and meta-analysis of social functioning in autism emphasized that social difficulties in ASD are multidimensional and encompass several interacting processes rather than a single global deficit (Li et al., 2026). Accordingly, an intervention that simultaneously targets attention to peers, reciprocal communication, motivation to engage, and cooperative behavior may produce broader changes than an intervention focused on only one discrete skill.

The significant reduction in SRS-2 scores may also be understood in relation to the core clinical characteristics of ASD. Persistent difficulties in social communication and social interaction are central diagnostic features of autism spectrum disorder and can affect social-emotional reciprocity, nonverbal communicative behaviors, and the development and maintenance of relationships (American Psychiatric, 2022). These difficulties may contribute to reduced participation in peer activities and fewer opportunities to practice socially adaptive behavior. Lord et al. have emphasized the considerable heterogeneity of autism but also the importance of social-communication functioning as a major determinant of everyday adaptation and support needs (Lord et al., 2018). From this perspective, peer-mediated intervention may be effective because it directly addresses one of the contexts in which the core difficulties of ASD are most visible: reciprocal interaction with age-matched social partners. The intervention does not attempt to alter social functioning only through abstract instruction but instead creates repeated opportunities to experience, practice, and reinforce interaction within the social context in which those skills are ultimately needed.

Another important finding was that the difference between posttest and follow-up scores was not statistically significant. This suggests that the benefits achieved

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immediately following the intervention were largely maintained two months later. Maintenance is an important criterion in evaluating social intervention because short-term change observed under structured conditions does not necessarily indicate lasting improvement. The present pattern is compatible with the premise that peer-mediated interventions may facilitate generalization and maintenance by embedding target behaviors within naturally meaningful interpersonal exchanges. Watkins et al. noted that one of the potential advantages of peer-mediated intervention is that skills can be practiced with social partners who resemble those encountered in children's everyday environments, potentially enhancing generalization beyond therapist-led sessions (Watkins et al., 2015). Similarly, the peer-mediated literature reviewed by Chang and Locke suggests that interventions involving naturally available peers may increase the likelihood that social behaviors continue after formal instruction has ended (Chang & Locke, 2016). The absence of significant deterioration from posttest to follow-up in the present study may therefore indicate that participants were able to retain at least part of the social learning acquired during the intervention.

The maintenance of intervention effects may also have been facilitated by the progressive design of the protocol. Early sessions focused on basic interaction and responsiveness, whereas later sessions emphasized cooperative participation, social support, maintaining interaction, and generalizing skills across activities, materials, and peer partners. This progression may have reduced dependence on a single prompt, activity, or interaction partner. In particular, the explicit inclusion of generalization exercises near the end of the intervention may have strengthened participants' ability to use acquired behaviors under changing conditions. Ragaglia et al., in their systematic review of peer-mediated social-skills interventions in school settings, emphasized the importance of understanding intervention outcomes in terms of participation and environmental functioning as well as individual skill acquisition (Ragaglia et al., 2026). The present findings are compatible with this biopsychosocial perspective because peers functioned not only as models but also as environmental facilitators who increased access to reciprocal social participation.

The results are also consistent with current evidence concerning social inclusion in educational settings. Tsou et al. highlighted that improving the inclusion of autistic pupils requires more than teaching isolated social behaviors; it also requires intervention strategies that modify opportunities for participation and support positive interaction with classmates (Tsou et al., 2026). Peer-mediated approaches are particularly relevant in this regard because they distribute responsibility for successful social interaction across both the child with ASD and the surrounding social environment. Instead of conceptualizing the autistic child as the sole target of change, peer-mediated intervention trains and organizes peers to respond in more supportive, predictable, and facilitative ways. This may reduce social barriers and increase the probability that children with ASD experience successful interactions. The present study's findings therefore support an ecological interpretation of social intervention in which improvement arises from both child-level learning and a more supportive interactional context.

The results are further compatible with the wider literature on social-skills interventions for children with ASD. Alahmari et al. concluded that social-skills training is generally effective in improving social functioning among children with autism, although intervention outcomes vary according to the characteristics and intensity of the program (Alahmari et al., 2025). Peer-mediated intervention represents one form of social-skills training that may offer particular advantages because of its emphasis on naturalistic practice, reciprocity, and immediate social reinforcement. This is especially relevant in early childhood, when peer interaction becomes increasingly important for learning social rules, cooperation, emotional understanding, and group participation. Yardeni-Stern et al. identified peer interaction as an important domain of functioning among autistic children and adolescents and showed that differences in the quality and reciprocity of peer relationships can affect broader social experiences (Yardeni-Stern et al., 2026). Interventions that directly increase successful peer encounters may therefore have consequences beyond performance on a standardized social measure by potentially broadening children's access to social learning opportunities.

The age of the participants may also have contributed to the observed intervention effects. At approximately six years of age, children are undergoing an important transition toward more structured group participation, peer cooperation, rule-governed play, and classroom interaction. Intervening at this developmental stage may be advantageous because social patterns remain relatively malleable and children are frequently exposed to new social demands. Hyman et al. emphasized the importance of early identification and developmentally appropriate intervention for children with ASD, particularly when interventions target functional difficulties that affect participation in

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family, educational, and community contexts (Hyman et al., 2020). The current intervention was structured around short, repeated, interactive sessions and age-appropriate group activities, which may have helped maintain engagement while providing sufficient repetition for learning. The use of a familiar peer context may also have reduced the abstraction involved in social-skills teaching, making target behaviors more concrete and immediately useful.

The present findings can additionally be interpreted in light of research demonstrating the modifiability of children's social skills more generally. Structured interventions based on interactive and participatory experiences have been shown to improve social and social-cognitive outcomes across child populations. For instance, storytelling has been associated with improvements in affective perspective taking and social problem solving in schoolchildren (Ghasemi et al., 2024), while serious-game interventions have demonstrated benefits for social interaction alongside cognitive and executive outcomes in children with attention-deficit/hyperactivity disorder (MirHoseini et al., 2024). A systematic review of game-based interventions likewise concluded that appropriately structured games can provide effective opportunities for practicing social skills through participation, communication, and shared goals (Kargar Khorami et al., 2026). Although these interventions differ from peer mediation, they support a common developmental principle: social competencies can be strengthened when children are provided with structured opportunities for active practice, feedback, repetition, and engagement with others.

Environmental conditions may also influence children's social development. Dehghan Banadaki highlighted the relationship between young children's digital-device use and social development, drawing attention to the importance of the quality and quantity of children's direct interpersonal experiences (Dehghan Banadaki, 2024). Peer-mediated intervention may be understood partly as an effort to deliberately enrich such interpersonal opportunities. For children with ASD who may otherwise participate less frequently in spontaneous peer interaction, systematically arranging positive social exchanges can increase exposure to experiences from which social learning is derived. The intervention's cooperative and reciprocal format may therefore function not only as direct skill training but also as an environmental enrichment strategy.

The present findings also have relevance for interventions involving children with other developmental needs. Vatankhah et al. found that structured psychosocial interventions could improve social skills in students with intellectual disability, further demonstrating that social functioning can respond to organized and developmentally appropriate psychological intervention (Vatankhah et al., 2024). Although the mechanisms and clinical characteristics of ASD differ from those of intellectual disability, the broader implication is that social skills should not be regarded as static traits. Rather, they can be shaped through structured interpersonal experiences when intervention is matched to developmental capacities and delivered consistently. In the current study, the integration of modeling, reciprocal learning, cooperative activity, social reinforcement, and positive feedback may have contributed to the observed improvement by addressing both skill acquisition and opportunities for social performance.

5. Conclusion

Taken together, the findings support peer-mediated intervention as a promising approach for improving social responsiveness in young children with autism spectrum disorder. The combination of significant pretest-to-posttest improvement, significant pretest-to-follow-up improvement, a significant Time × Group interaction, and the absence of significant deterioration between posttest and follow-up suggests that the intervention produced effects that were both immediate and relatively stable over the short-term follow-up period. These findings are broadly consistent with randomized trials, systematic reviews, and contemporary models emphasizing participation and social inclusion (Gunning et al., 2019; Kamps et al., 2015; Kasari et al., 2012; Keuffer & de Souza, 2023; Ragaglia et al., 2026). The results therefore add support to the view that peers can be systematically incorporated into intervention as meaningful social partners capable of promoting reciprocal interaction, practice, reinforcement, and generalization in children with ASD.

The present study has several limitations that should be considered when interpreting its findings. First, the sample was relatively small and consisted of 30 six-year-old children recruited from a single psychological clinic in Rasht, which limits the generalizability of the findings to children of different ages, developmental levels, geographic regions, and clinical backgrounds. Second, convenience sampling was used before random allocation to study groups, which may have introduced selection bias at the recruitment stage. Third, the principal outcome measure relied on parent report, and although the SRS-2 is a

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standardized instrument, parent ratings may be influenced by expectancy effects or awareness of the child's group assignment. Fourth, the follow-up period was limited to two months and therefore does not establish whether the observed improvements persist over longer periods. Fifth, the study did not systematically examine potential moderators such as autism symptom severity, language ability, cognitive functioning, previous intervention history, quality of peer relationships, or parental involvement. Finally, the study focused primarily on quantitative changes in social responsiveness and did not include direct observational measures of peer interaction in naturalistic settings.

Future studies should replicate the present findings using larger and more diverse samples recruited from multiple clinical and educational settings and should include children across a broader age range and different levels of autism-related support needs. Longer follow-up periods of six months or one year would provide stronger evidence concerning the durability of intervention effects. Future research should also combine standardized parent- and teacher-report measures with direct behavioral observation of social initiations, responses, duration of reciprocal interaction, cooperative play, and generalization across classroom, playground, home, and community settings. Examining potential moderators and mediators would also be valuable, particularly language ability, baseline social motivation, cognitive level, intervention fidelity, peer characteristics, and the quality of peer-child relationships. Comparative trials could evaluate peer-mediated intervention against therapist-led social-skills training, parent-mediated intervention, technology-assisted approaches, or combinations of these methods. Researchers should also investigate which intervention components are most responsible for improvement and determine the optimal frequency, duration, and intensity of peer-mediated programs.

In practice, psychologists, educators, special-education professionals, and rehabilitation teams may consider incorporating structured peer-mediated activities into social-skills programs for young children with autism spectrum disorder. Implementation should involve careful selection and preparation of peers, clear identification of target behaviors, brief and developmentally appropriate activities, systematic opportunities for turn-taking and cooperative participation, positive reinforcement, and gradual generalization across people and settings. Peer-mediated activities may be particularly useful in preschool and early primary-school environments because they can be integrated into play, classroom routines, cooperative tasks, and group learning rather than being limited to isolated clinical sessions. Practitioners should monitor each child's response to the intervention and adjust task complexity, prompting, peer support, and reinforcement according to individual developmental needs. Collaboration among clinicians, teachers, and parents may also help ensure that newly acquired social behaviors are practiced consistently across daily environments and become functional parts of the child's everyday social repertoire.

Authors' Contributions

Authors equally contributed to this article.

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In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

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Declaration of Interest

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Ethics Considerations

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