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Effectiveness of Mother–Child Interaction Training on Communication Skills, Mother–Child Relationship, and Attachment Problems in Children with Attention-Deficit/Hyperactivity Disorder

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A B S T R A C T

Purpose: This study aimed to determine the effectiveness of mother–child interaction training on communication skills, mother–child relationship, and attachment problems in children with attention-deficit/hyperactivity disorder (ADHD).

Methods and Materials: The present study employed a quasi-experimental pretest–posttest design with a control group and a two-month follow-up. The statistical population consisted of children with ADHD and their mothers attending psychological and psychiatric centers in Tehran, Iran. Thirty mother–child dyads were selected through purposive sampling and assigned to an intervention group (n = 15) and a control group (n = 15). Mothers in the intervention group participated in ten weekly 90-minute mother–child interaction training sessions, whereas the control group received no structured intervention during the study period. Data were collected using measures of children's communication skills, mother–child relationship quality, and attachment problems at pretest, posttest, and follow-up. Data were analyzed using repeated-measures multivariate analysis of variance, followed by univariate tests and Bonferroni-adjusted pairwise comparisons.

Findings: The multivariate time × group interaction was statistically significant, Wilks' Lambda = .198, $F(6, 23) = 15.54$, $p < .001$, partial $\eta^2 = .802$. Significant time × group interactions were also observed for communication skills, $F(2, 56) = 30.86$, $p < .001$, partial $\eta^2 = .524$; mother–child relationship, $F(2, 56) = 34.92$, $p < .001$, partial $\eta^2 = .555$; and attachment problems, $F(1.63, 45.64) = 37.56$, $p < .001$, partial $\eta^2 = .573$. Bonferroni comparisons showed significant improvements from pretest to posttest and from pretest to follow-up in the intervention group, while posttest–follow-up differences were nonsignificant.

Conclusion: Mother–child interaction training was effective in improving communication skills and mother–child relationship quality and reducing attachment problems in children with ADHD, and these effects were maintained over the two-month follow-up period.

Keywords: *Attention-deficit/hyperactivity disorder; Mother–child interaction; Communication skills; Mother–child relationship; Attachment problems*

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders of childhood and is characterized by persistent patterns of inattention, hyperactivity, and impulsivity that interfere with age-appropriate functioning across family, educational, and social settings. Although the clinical manifestations of ADHD are typically defined in terms of attentional and behavioral dysregulation, the consequences of the disorder extend far beyond the child's individual symptoms. Difficulties in emotional regulation, behavioral inhibition, sustained attention, reciprocal communication, compliance with parental expectations, and interpretation of social cues can substantially affect the quality of everyday interactions between children and their caregivers. For mothers, who frequently assume the primary caregiving role, repeated exposure to challenging behaviors, academic concerns, social difficulties, and unpredictable patterns of child responsiveness may increase parenting stress and undermine confidence in the parenting role. Recent studies have emphasized that mothers of children with ADHD may experience considerable psychosocial strain, stigmatization, uncertainty, and emotional burden associated with the child's diagnosis and behavior (Mthembu & Ndaba, 2025). Likewise, maternal adjustment may become particularly difficult when ADHD co-occurs with other developmental or behavioral problems, suggesting that the psychological functioning of mothers is closely linked to the complexity of their child's clinical presentation (Nagase et al., 2024). These observations indicate that ADHD should not be conceptualized solely as an individual disorder of the child but also as a condition embedded within a dynamic parent–child relational system.

One of the domains that may be particularly vulnerable in children with ADHD is communication. Effective communication in childhood involves more than language production and comprehension; it also requires sustained attention to the conversational partner, recognition of verbal and nonverbal signals, turn-taking, responsiveness, emotional attunement, and the ability to regulate behavior in accordance with the social context. Children with attentional and impulse-control difficulties may interrupt conversations, fail to maintain topic coherence, overlook contextual cues, respond prematurely, or have difficulty adapting their communication to the emotional state of the other person. When these patterns repeatedly occur within the family, they may contribute to misunderstandings and escalation of conflict. Research on parent–child communication has consistently shown that the quality of interaction between children and parents is associated with emotional and psychological outcomes across development. For example, communication and conflict within mother–adolescent relationships have been shown to affect the psychological well-being of both mothers and children, illustrating the reciprocal nature of family communication processes (Cho & Han, 2021). Difficulties in mother–child communication may also have longer-term consequences, as communication apprehension in this relationship has been associated with lower resilience and self-esteem and with greater depressive symptoms in young adults (Curran et al., 2020). Thus, communication within the mother–child dyad represents an important developmental context rather than a simple exchange of information.

The significance of parental communication is also evident in research on children with developmental and communication difficulties. Parental involvement has been associated with the development of communication skills among children with autism spectrum disorder, suggesting that caregivers can function as active agents in the child's communicative development rather than merely observers of treatment (Tenerife et al., 2023). Similarly, studies of structured parent-training approaches have shown that improving parents' communication strategies can support children's interaction and language development. A systematic review of the Hanen parent training program, for example, highlighted the potential value of parent-mediated approaches for strengthening communication, interaction, and language skills in children with autism spectrum disorder (Mohammadzadeh et al., 2024). Parent training, applied behavior analysis, and video-modeling approaches have likewise been examined as methods of promoting social communication competencies in children with neurodevelopmental difficulties (Bordini et al., 2024). Although these studies have predominantly focused on autism and related communication disorders, their findings support a broader developmental principle: changes in caregiver responsiveness, communication style, and interaction patterns can create a relational environment that facilitates the child's acquisition and use of adaptive communication skills.

The mother–child relationship is another central domain of functioning that may be disrupted in families of children with ADHD. The repeated occurrence of inattentive, impulsive, oppositional, or emotionally dysregulated behavior can create a cycle in which mothers increase

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monitoring, criticism, commands, or controlling responses, while children become more resistant, avoidant, emotionally reactive, or dependent. Over time, these reciprocal patterns may reduce warmth and enjoyment in the relationship and increase conflict. Intervention research suggests that modifying parental interaction patterns can improve both child functioning and the quality of the parent–child relationship. Problem-solving interventions have been shown to improve mothers' interactions with children who experience communication problems (Kakabraee, 2020), while nonviolent communication training has been associated with improvements in mother–child interaction among mothers of children with intellectual disabilities (Rezaei et al., 2019). Cognitive-based problem-solving training has also been found to alter maladaptive parenting styles and reduce parental anger, indicating that changes in parental cognitive and behavioral responses may have direct relational benefits (Shokoohi Yekta & Motamed Yeganeh, 2024). More recently, skill-based knowledge-enhancement programs have demonstrated potential for improving the emotional and communicative functioning of parents of adolescent children, further emphasizing the value of structured parental education in modifying family interactions (Mousavi et al., 2025).

Parenting interventions may be particularly relevant for mothers of children with ADHD because these mothers often experience diminished parental self-efficacy and elevated stress. Positive parenting training has been reported to reduce parenting stress and improve parental self-efficacy among mothers of children with ADHD (Paknejad et al., 2025). Similarly, parenting training based on acceptance and commitment principles has been associated with improved parent–child interaction, maternal self-efficacy, and psychological flexibility in mothers of children with ADHD (Jalilian et al., 2025). These findings are important because maternal self-efficacy and flexibility may affect not only the mother's subjective well-being but also her ability to respond consistently and sensitively to the child's behavior. A mother who feels overwhelmed, ineffective, or emotionally reactive may rely more heavily on coercive strategies, whereas increased confidence and emotional flexibility may facilitate more contingent, calm, and developmentally appropriate responses. Consequently, interventions that directly target mother–child interaction may have the potential to influence multiple levels of functioning simultaneously, including maternal behavior, child communication, relationship quality, and emotional security.

The concept of dyadic synchrony provides another useful framework for understanding the mechanisms through which interaction-focused interventions may operate. Dyadic synchrony refers to the coordinated and reciprocal timing of emotional, behavioral, and communicative exchanges between caregiver and child. When mother and child are mutually responsive, the child receives predictable social feedback and experiences the caregiver as emotionally available and understandable. Research on play-based communication and behavior intervention has identified mother–child dyadic synchrony as an important predictor of treatment-related change in children at high risk for autism spectrum disorder (Fu et al., 2020). Verbal communication between mothers and young children has similarly been linked with the development of children's self-regulation, suggesting that everyday interactive exchanges may support the child's capacity to manage attention, emotion, and behavior (Yu, 2018). These processes may be especially important for children with ADHD, whose core difficulties involve regulation across several domains. Training mothers to slow down interactions, attend carefully to the child's cues, reinforce adaptive behavior, validate emotional experiences, and establish predictable reciprocal exchanges may therefore provide repeated opportunities for the child to practice communication and self-regulatory skills within a secure interpersonal context.

Attachment processes are closely intertwined with these patterns of communication and relational responsiveness. Attachment develops through repeated experiences in which caregivers respond to the child's signals of distress, proximity seeking, exploration, and emotional need. When caregivers are consistently available and responsive, children are more likely to develop expectations that support emotional security, trust, and adaptive regulation. In contrast, inconsistent, intrusive, rejecting, or highly conflictual interactions may contribute to insecure or disorganized relational patterns. Contemporary evidence supports a strong connection between parent–child attachment and children's emotional regulation. Parent–child attachment has been associated with children's ability to regulate emotions, indicating that emotional security within the caregiving relationship may provide a foundation for managing affective states effectively (Ferreira et al., 2024). Attachment relationships may also interact dynamically across family members; mother–child and father–child attachment have been shown to have transactional relationships with self-compassion,

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highlighting the broader developmental implications of attachment quality (Song et al., 2023).

The quality of the broader family emotional climate can also affect attachment security and socioemotional development. The relationship between mothers and fathers has been linked to children's social-emotional competence through parental emotional expression and parent–child attachment, supporting a chain of influence from family relationships to children's emotional outcomes (Tang et al., 2023). Likewise, child temperament, maternal attachment, and parenting style have been identified as predictors of behavioral problems in young children (Yousefi Khaneh Bargh & Zeynali, 2024). Parenting styles may influence child behavior partly through attachment mechanisms, as maternal parenting practices and children's attachment styles have been associated with behavioral disorders (Haji Adineh et al., 2024). These findings suggest that attachment-related difficulties should not be treated as isolated child characteristics; rather, they may reflect repeated relational transactions between the child's temperament and behavior and the caregiver's responsiveness, expectations, emotional availability, and regulation.

Maternal reflective functioning is another mechanism relevant to attachment and behavioral adjustment. Reflective functioning refers to the caregiver's ability to understand the child's behavior in terms of underlying mental states, such as feelings, needs, intentions, and fears. When mothers are able to interpret disruptive behavior not only as disobedience but also as an expression of frustration, dysregulation, anxiety, or unmet relational need, they may be better able to respond sensitively rather than reactively. Research has demonstrated associations between attachment dimensions, maternal reflective functioning, and preschool children's aggression, with child abuse potential playing a mediating role in these relationships (Talebian Sharif et al., 2023). This line of evidence is especially relevant in ADHD because behaviors driven by impulsivity or poor inhibitory control may easily be interpreted by parents as deliberate defiance. Interaction-focused training may help mothers reframe these behaviors, respond more contingently, and reduce emotionally escalated cycles that may otherwise damage relational security.

Attachment-based interventions have produced encouraging findings in various child and family populations. Training mothers through attachment-oriented approaches has been associated with reductions in school refusal and improvements in social competence among children with separation anxiety disorder (Motevally Joybari et al., 2024). Attachment-based mother training has also been found to reduce multidimensional anxiety among children with separation anxiety difficulties (Khajeh Goldloo & Farshbaf Manisefat, 2025). In another study, attachment-based play therapy was associated with improvements in maternal parental self-efficacy and emotion regulation as well as children's social adjustment (Sadeghi et al., 2025). Comparative evidence further suggests that attachment-based therapy may have beneficial effects on maladaptive cognitive patterns in mothers of preschool and elementary-school children (Haghiri et al., 2025). Importantly, some attachment-focused preventive interventions have demonstrated effects that persist well beyond the immediate treatment period; long-term follow-up of an attachment-based program involving both mothers and fathers has shown meaningful outcomes several years after intervention (Walter et al., 2024). Collectively, these findings suggest that strengthening caregiver sensitivity, emotional availability, and relational attunement may produce durable benefits across multiple developmental domains.

Nevertheless, much of the intervention literature has examined communication, parenting behavior, parent–child relationship quality, and attachment separately, and relatively fewer studies have evaluated these domains simultaneously in children with ADHD. This is an important limitation because these constructs are conceptually and developmentally interconnected. Communication is the behavioral medium through which relational patterns are enacted; the quality of the mother–child relationship provides the emotional context in which communication occurs; and attachment security reflects the child's emerging expectations regarding the caregiver's availability, responsiveness, and reliability. Interventions that target only child symptoms may therefore overlook the interpersonal processes that either maintain or buffer the functional consequences of ADHD. Conversely, mother–child interaction training can address these domains in an integrated manner by increasing positive attention, reciprocal communication, emotional validation, sensitivity to child signals, consistency in behavioral responses, and opportunities for successful shared interaction.

The clinical relevance of such an approach is further reinforced by evidence that parental emotional functioning and parent–child relational quality are modifiable. Improvements in communication strategies, parenting knowledge, problem solving, emotional expression, and attachment responsiveness have repeatedly been associated

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with beneficial outcomes across child populations (Kakabraee, 2020; Mousavi et al., 2025; Rezaei et al., 2019; Shokoohi Yekta & Motamed Yeganeh, 2024). Parent-mediated intervention research also demonstrates that parents can be trained to become more effective facilitators of children's communication and adaptive functioning (Bordini et al., 2024; Mohammadzadeh et al., 2024). For children with ADHD specifically, the demonstrated effects of parenting interventions on parental stress, self-efficacy, psychological flexibility, and interaction quality provide a strong foundation for examining a more explicitly relational intervention model (Jalilian et al., 2025; Paknejad et al., 2025). Such interventions may be particularly valuable because improvements achieved within the mother–child relationship can be practiced repeatedly in natural daily contexts, potentially increasing the generalizability and maintenance of therapeutic gains.

Accordingly, the present study aimed to determine the effectiveness of mother–child interaction training on communication skills, the mother–child relationship, and attachment problems in children with attention-deficit/hyperactivity disorder.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a quasi-experimental pretest–posttest design with a control group and a follow-up assessment to investigate the effectiveness of mother–child interaction training on communication skills, the mother–child relationship, and attachment problems among children with attention-deficit/hyperactivity disorder (ADHD). The statistical population consisted of children with ADHD and their mothers who attended child and adolescent psychological and psychiatric clinics in Tehran, Iran. A total of 30 mother–child dyads were selected through purposive sampling based on the eligibility criteria and were subsequently allocated to an intervention group (n = 15) and a control group (n = 15). The children were between 7 and 12 years of age and had received a diagnosis of ADHD based on clinical evaluation by a child psychiatrist or clinical psychologist and the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders. Inclusion criteria were a confirmed diagnosis of ADHD, an age range of 7–12 years, living with the biological mother, the mother's willingness and ability to participate regularly in the intervention sessions, absence of severe intellectual disability or major neurological disorders in the child, absence of psychotic disorders or other severe psychiatric conditions requiring immediate intensive treatment, and provision of written informed consent by the mother. Mothers were required to have at least a basic level of literacy sufficient to complete the study questionnaires and participate in the training activities. Exclusion criteria included absence from more than two intervention sessions, initiation of another structured psychological intervention during the study, occurrence of a serious family or medical crisis that prevented continued participation, incomplete questionnaires, and withdrawal of consent at any stage of the study. Before the intervention, participants in both groups completed the study measures as a pretest. Mothers in the intervention group then received the mother–child interaction training program, whereas participants in the control group received no structured psychological training during the same period and continued to receive routine services when applicable. Immediately after completion of the intervention, both groups completed the measures again as the posttest, and a follow-up assessment was conducted two months later to examine the stability of the intervention effects. Participants were informed of the objectives and procedures of the research, the voluntary nature of participation, the confidentiality of their information, and their right to withdraw from the study without adverse consequences. To observe ethical considerations, the mothers in the control group were offered access to the educational materials after completion of the follow-up assessment.

2.2. Instruments

The Children's Communication Checklist–Second Edition (CCC-2) was used to assess children's communication skills. The CCC-2 is a parent-report instrument designed to evaluate different dimensions of communication in children, including speech, syntax, semantics, coherence, inappropriate initiation, stereotyped language, use of context, nonverbal communication, social relations, and interests. Mothers rated the frequency with which each statement described their child's communicative behavior according to the response format specified by the instrument. The questionnaire provides information about both structural and pragmatic aspects of communication and is particularly useful for identifying difficulties in the social use of language that may interfere with everyday interpersonal functioning. For the purposes of the present study, the overall communication score was used as the

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principal index of the child's communication functioning, with scoring conducted according to the standard instructions of the instrument. Higher scores reflecting better communication functioning were interpreted as indicating greater competence in the child's ability to initiate, maintain, and regulate verbal and nonverbal interactions. The questionnaire was administered to mothers at the pretest, posttest, and follow-up stages under standardized conditions.

The Child–Parent Relationship Scale (CPRS) developed by Pianta was used to evaluate the quality of the mother–child relationship. This parent-report instrument assesses the parent's perception of the affective and interpersonal characteristics of the relationship with the child and primarily covers dimensions such as closeness, conflict, and dependency. The closeness dimension reflects warmth, open communication, affection, and emotional connectedness between the mother and child, whereas the conflict dimension assesses tension, negativity, disagreement, and problematic interactions. The dependency dimension reflects excessive reliance and developmentally inappropriate dependence within the relationship. Mothers were asked to indicate the extent to which each statement represented their current relationship with their child using the scale's response options. Item scores were calculated in accordance with the standard scoring procedure, and dimension scores as well as an overall index of relationship quality were obtained where appropriate. In the present study, higher levels of closeness and lower levels of conflict and maladaptive dependency were considered indicative of a more positive mother–child relationship. The measure was completed independently by the mothers at all three assessment stages.

The Attachment Problems Questionnaire was used to assess children's attachment-related difficulties. This measure evaluates behavioral and emotional manifestations associated with insecure or disturbed attachment, including problems with emotional trust, proximity seeking, interpersonal security, affect regulation, responsiveness to caregivers, separation-related distress, and maladaptive patterns of closeness or avoidance. Mothers evaluated the extent to which each statement corresponded to their child's usual behavior and emotional responses in the family context. The items were scored according to the standard response format of the questionnaire, and the item scores were summed to obtain an overall index of attachment-related problems. Higher total scores represented more pronounced attachment difficulties, whereas lower scores indicated fewer attachment-related problems and more adaptive attachment-related functioning. The questionnaire was selected because the intervention was expected to affect not only observable patterns of mother–child interaction but also children's sense of emotional security, responsiveness to maternal availability, and regulation of attachment-related behaviors. The measure was administered at pretest, posttest, and follow-up using identical instructions across assessment occasions.

2.3. Intervention

The mother–child interaction training program was conducted for the mothers assigned to the intervention group in ten weekly sessions, each lasting approximately 90 minutes. The intervention was structured around behavioral, attachment-oriented, and parent–child interaction principles and was designed to improve the quality of reciprocal communication between mother and child, increase maternal responsiveness, decrease coercive or ineffective interaction patterns, and strengthen emotional security within the mother–child relationship. The initial sessions focused on psychoeducation concerning ADHD, the influence of core ADHD symptoms on family interactions, identification of dysfunctional interaction cycles, and recognition of the child's emotional and communicative needs. Mothers were subsequently trained in attending to positive child behavior, active listening, appropriate eye contact, descriptive commenting, emotional validation, reflection of the child's verbal expressions, and the use of developmentally appropriate praise. Later sessions emphasized child-led interaction, increasing positive shared activities, reducing excessive criticism and commands, giving clear and effective instructions, establishing consistent behavioral expectations, using logical and predictable consequences, and managing oppositional or impulsive behaviors without escalation of conflict. Particular attention was given to recognizing attachment-related signals, responding sensitively to the child's distress, increasing the mother's emotional availability, repairing interactional ruptures, and providing predictable reassurance and support. Mothers practiced the techniques through therapist modeling, role-play, guided rehearsal, discussion of actual mother–child interactions, and structured home assignments. They were asked to implement the learned skills during daily interactions with their children and to record important experiences and difficulties for review during the following session. At the beginning of each subsequent session,

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homework was reviewed and corrective feedback was provided. The final sessions focused on integrating the acquired skills, identifying high-risk situations for the recurrence of dysfunctional interaction patterns, developing individualized strategies for maintaining positive communication, and consolidating improvements in the mother–child relationship. The control group did not participate in the mother–child interaction training sessions during the study period.

2.4. Data Analysis

Data were analyzed using IBM SPSS Statistics. Prior to inferential analyses, the data were screened for completeness, coding errors, outliers, and violations of statistical assumptions. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were calculated to describe the demographic characteristics of participants and the distribution of the study variables at the pretest, posttest, and follow-up stages. The normality of the dependent variables was examined using the Shapiro–Wilk test together with inspection of skewness and kurtosis indices. Homogeneity of variances was evaluated using Levene's test, and the assumption of equality of covariance matrices was examined using Box's M test where applicable. Because the study involved two groups assessed repeatedly across three measurement occasions, repeated-measures multivariate analysis of variance was used to examine changes in communication skills, mother–child relationship, and attachment problems over time and to determine whether patterns of change differed between the intervention and control groups. Mauchly's test was used to examine the sphericity assumption, and when this assumption was violated, the Greenhouse–Geisser correction was applied. Significant multivariate and interaction effects were followed by univariate analyses and pairwise comparisons with an appropriate adjustment for multiple comparisons. Effect sizes were reported using partial eta squared to indicate the magnitude of intervention effects. Statistical significance was set at $p < .05$ for all analyses.

3. Findings and Results

The final analysis included all 30 mother–child dyads who completed the pretest, posttest, and two-month follow-up assessments, comprising 15 participants in the mother–child interaction training group and 15 participants in the control group. The mean age of the children in the intervention group was 9.13 years (SD = 1.46), compared with 9.27 years (SD = 1.39) in the control group. In terms of sex distribution, 11 children (73.3%) in the intervention group and 10 children (66.7%) in the control group were boys, while 4 children (26.7%) in the intervention group and 5 children (33.3%) in the control group were girls. The mean age of mothers was 36.87 years (SD = 4.21) in the intervention group and 37.33 years (SD = 4.48) in the control group. Regarding maternal educational level, 4 mothers (26.7%) in the intervention group and 5 mothers (33.3%) in the control group had completed high school or held a diploma, 8 mothers (53.3%) in the intervention group and 7 mothers (46.7%) in the control group held a bachelor's degree, and 3 mothers (20.0%) in each group held a master's degree or higher. In the intervention group, 10 mothers (66.7%) were homemakers and 5 (33.3%) were employed, whereas 9 mothers (60.0%) in the control group were homemakers and 6 (40.0%) were employed. The mean duration since the child's diagnosis of attention-deficit/hyperactivity disorder was 2.07 years (SD = 0.88) in the intervention group and 2.13 years (SD = 0.92) in the control group. Independent-samples t-tests and chi-square tests indicated no statistically significant differences between the two groups in child age, maternal age, duration since diagnosis, child sex, maternal educational level, or maternal employment status ($p > .05$). Therefore, the intervention and control groups were considered comparable with respect to the principal demographic and background characteristics at baseline.

Table 1

Descriptive Statistics for Communication Skills, Mother–Child Relationship, and Attachment Problems Across Assessment Stages

Variable	Group	Pretest, M ± SD	Posttest, M ± SD	Follow-up, M ± SD
Communication skills	Intervention	53.27 ± 6.18	67.80 ± 5.74	66.47 ± 5.91
Communication skills	Control	52.93 ± 6.42	54.07 ± 6.31	53.60 ± 6.48
Mother–child relationship	Intervention	61.73 ± 7.02	76.60 ± 6.31	75.13 ± 6.54
Mother–child relationship	Control	62.20 ± 6.85	63.47 ± 6.96	63.00 ± 7.08
Attachment problems	Intervention	48.87 ± 5.93	34.20 ± 5.41	35.53 ± 5.62
Attachment problems	Control	48.33 ± 6.11	47.27 ± 6.04	47.80 ± 6.18

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As shown in Table 1, the pretest mean scores of the intervention and control groups were highly similar across all three dependent variables, suggesting that the groups were relatively comparable before implementation of the mother–child interaction training program. Communication skills in the intervention group increased from a pretest mean of 53.27 (SD = 6.18) to 67.80 (SD = 5.74) at posttest and remained relatively stable at 66.47 (SD = 5.91) at the two-month follow-up. In contrast, the control group showed only a small change, from 52.93 (SD = 6.42) at pretest to 54.07 (SD = 6.31) at posttest and 53.60 (SD = 6.48) at follow-up. A comparable pattern was observed for the quality of the mother–child relationship. The intervention group's mean score increased substantially from 61.73 (SD = 7.02) at pretest to 76.60 (SD = 6.31) at posttest and remained high at follow-up, with a mean of 75.13 (SD = 6.54). The control group, however, demonstrated only minimal variation across the three stages, with mean scores of 62.20 (SD = 6.85), 63.47 (SD = 6.96), and 63.00 (SD = 7.08), respectively. With respect to attachment problems, for which lower scores represented more favorable functioning, the intervention group demonstrated a marked reduction from 48.87 (SD = 5.93) at pretest to 34.20 (SD = 5.41) at posttest, and this improvement was largely maintained at follow-up, with a mean score of 35.53 (SD = 5.62). By comparison, attachment-problem scores in the control group remained relatively unchanged across pretest, posttest, and follow-up assessments. Overall, the descriptive results indicate that the most pronounced changes occurred in the intervention group following mother–child interaction training and that these improvements were substantially preserved during the follow-up period.

Prior to conducting the repeated-measures multivariate analysis, the assumptions required for parametric analysis were examined. The Shapiro–Wilk test was nonsignificant for communication skills, mother–child relationship, and attachment-problem scores within each group and assessment stage ($p > .05$), indicating no substantial departure from normality. Examination of skewness and kurtosis coefficients similarly showed that all values were within acceptable ranges. Levene's test was nonsignificant for all dependent variables at the pretest, posttest, and follow-up stages ($p > .05$), supporting the assumption of homogeneity of error variances between groups. Box's M test was also nonsignificant, Box's M = 18.42, F = 1.21, p = .238, indicating equality of covariance matrices across the intervention and control groups. Mauchly's test of sphericity was nonsignificant for communication skills and mother–child relationship scores but significant for attachment problems. Accordingly, the Greenhouse–Geisser correction was applied to the within-subject analyses for attachment problems. These findings indicated that the principal statistical assumptions were sufficiently satisfied for repeated-measures multivariate and univariate analyses.

Table 2

Multivariate Tests of the Effects of Time, Group, and Time × Group Interaction on the Combined Dependent Variables

Effect	Wilks' Lambda	F	df	Error df	p	Partial η^2
Time	.284	10.84	6	23	< .001	.716
Group	.403	12.84	3	26	< .001	.597
Time × Group	.198	15.54	6	23	< .001	.802

The multivariate findings presented in Table 2 demonstrate statistically significant effects for time, group, and particularly the interaction between time and group on the combined set of dependent variables. The multivariate effect of time was significant, Wilks' Lambda = .284, $F(6, 23) = 10.84$, $p < .001$, partial $\eta^2 = .716$, indicating that, when communication skills, mother–child relationship, and attachment problems were considered simultaneously, participants' scores changed significantly across the pretest, posttest, and follow-up assessments. The between-group multivariate effect was also significant, Wilks' Lambda = .403, $F(3, 26) = 12.84$, $p < .001$, partial $\eta^2 = .597$, showing that the overall pattern of scores across the three dependent variables differed significantly between participants who received mother–child interaction training and those in the control condition. More importantly, the time × group interaction was statistically significant and had a large effect size, Wilks' Lambda = .198, $F(6, 23) = 15.54$, $p < .001$, partial $\eta^2 = .802$. This interaction indicates that changes over time were not equivalent in the two groups and that the trajectory from pretest to posttest and follow-up differed substantially according to group membership. Specifically,

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the intervention group exhibited improvements across the three outcome domains after receiving the mother–child interaction training, whereas scores in the control group remained comparatively stable. The large partial eta squared associated with the interaction effect indicates that a substantial proportion of multivariate variance in changes over time was associated with participation in the intervention. Because the multivariate interaction was significant, separate univariate repeated-measures analyses were subsequently performed for communication skills, mother–child relationship, and attachment problems to determine the specific variables responsible for the overall multivariate effect.

Table 3

Univariate Repeated-Measures Analysis of Variance for Communication Skills, Mother–Child Relationship, and Attachment Problems

Variable	Effect	df	Error df	F	p	Partial η^2
Communication skills	Time	2	56	39.62	< .001	.586
Communication skills	Group	1	28	21.47	< .001	.434
Communication skills	Time × Group	2	56	30.86	< .001	.524
Mother–child relationship	Time	2	56	42.18	< .001	.601
Mother–child relationship	Group	1	28	19.73	< .001	.413
Mother–child relationship	Time × Group	2	56	34.92	< .001	.555
Attachment problems	Time	1.63	45.64	46.37	< .001	.624
Attachment problems	Group	1	28	23.81	< .001	.459
Attachment problems	Time × Group	1.63	45.64	37.56	< .001	.573

As presented in Table 3, the univariate analyses confirmed statistically significant time × group interaction effects for each of the three study outcomes. For communication skills, the main effect of time was significant, $F(2, 56) = 39.62$, $p < .001$, partial $\eta^2 = .586$, indicating a significant overall change in communication skills across the three assessment stages. The main effect of group was also significant, $F(1, 28) = 21.47$, $p < .001$, partial $\eta^2 = .434$. Most importantly, the time × group interaction was significant, $F(2, 56) = 30.86$, $p < .001$, partial $\eta^2 = .524$, demonstrating that the observed increase in communication skills over time differed significantly between the intervention and control groups. Bonferroni-adjusted pairwise comparisons within the intervention group indicated that communication-skills scores were significantly higher at posttest than at pretest (mean difference = 14.53, $p < .001$) and significantly higher at follow-up than at pretest (mean difference = 13.20, $p < .001$). The difference between posttest and follow-up scores was not statistically significant (mean difference = 1.33, $p = .287$), indicating that the improvement achieved immediately after the intervention was largely maintained during the two-month follow-up period. In the control group, no significant differences were observed between pretest and posttest, pretest and follow-up, or posttest and follow-up scores ($p > .05$).

A similar pattern was found for the mother–child relationship. The main effect of time was statistically significant, $F(2, 56) = 42.18$, $p < .001$, partial $\eta^2 = .601$, and the between-group effect was also significant, $F(1, 28) = 19.73$, $p < .001$, partial $\eta^2 = .413$. More importantly, the time × group interaction reached statistical significance, $F(2, 56) = 34.92$, $p < .001$, partial $\eta^2 = .555$. Pairwise comparisons showed that the mean mother–child relationship score in the intervention group increased significantly from pretest to posttest (mean difference = 14.87, $p < .001$) and from pretest to follow-up (mean difference = 13.40, $p < .001$). The slight decrease from posttest to follow-up was not statistically significant (mean difference = 1.47, $p = .241$), demonstrating persistence of the intervention effect over the two-month follow-up interval. In contrast, changes across the three measurement occasions were not statistically significant in the control group ($p > .05$). These findings indicate that mothers who participated in the interaction training developed a more favorable relational pattern with their children, characterized by stronger positive interaction and improved overall relationship quality, and that this improvement continued after the structured training sessions had ended.

For attachment problems, the Greenhouse–Geisser-adjusted results also revealed a statistically significant main effect of time, $F(1.63, 45.64) = 46.37$, $p < .001$, partial $\eta^2 = .624$, as well as a significant main effect of group, $F(1, 28) = 23.81$, $p < .001$, partial $\eta^2 = .459$. The time × group interaction was statistically significant, $F(1.63, 45.64) = 37.56$, $p < .001$, partial $\eta^2 = .573$. Because lower scores

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indicated fewer attachment-related difficulties, this interaction reflected a substantially greater reduction in attachment-problem scores among children whose mothers received the intervention. Bonferroni-adjusted comparisons indicated that attachment-problem scores in the intervention group decreased significantly from pretest to posttest (mean difference = 14.67, $p < .001$) and from pretest to follow-up (mean difference = 13.34, $p < .001$). Although the mean score increased slightly from 34.20 at posttest to 35.53 at follow-up, the posttest–follow-up difference was not statistically significant (mean difference = −1.33, $p = .318$). Thus, there was no evidence of a substantial loss of treatment gains during the follow-up period. No statistically significant within-group changes in attachment problems were observed in the control group ($p > .05$).

Taken together, the descriptive, multivariate, and univariate findings consistently demonstrate that mother–child interaction training was associated with significant improvements in all three primary study outcomes. Children in the intervention group demonstrated substantially better communication skills after the intervention, mothers reported a more positive mother–child relationship, and attachment-related problems decreased markedly compared with both baseline scores and the control group. The nonsignificant differences between posttest and follow-up scores across all three variables further indicate that the beneficial effects observed immediately after training were maintained during the two-month follow-up period. The large effect sizes obtained for the time × group interactions—partial $\eta^2 = .524$ for communication skills, .555 for mother–child relationship, and .573 for attachment problems—suggest that the differences were not only statistically significant but also substantial in magnitude. Therefore, the findings support the effectiveness and short-term durability of mother–child interaction training for improving interpersonal communication and relational functioning and reducing attachment-related difficulties among children with attention-deficit/hyperactivity disorder.

4. Discussion and Conclusion

The present study investigated the effectiveness of mother–child interaction training on communication skills, the mother–child relationship, and attachment problems in children with attention-deficit/hyperactivity disorder (ADHD). The findings showed that children in the intervention group demonstrated significant improvements in communication skills and mother–child relationship scores and significant reductions in attachment problems from pretest to posttest, whereas the control group showed no meaningful changes across the same period. Furthermore, the improvements observed immediately after the intervention were largely maintained at the two-month follow-up. The significant time × group interaction effects across all three outcome variables indicated that the changes could not be attributed merely to the passage of time or repeated assessment. Rather, participation in the mother–child interaction training program was associated with a distinct pattern of improvement in relational and communicative functioning. The magnitude of the effect sizes further indicated that the intervention had a substantial impact on the studied outcomes. These findings support the view that intervention at the level of the mother–child dyad can be effective in addressing not only behavioral and relational difficulties but also communication and attachment-related problems associated with ADHD.

The first major finding was that mother–child interaction training significantly improved children's communication skills. This result is consistent with research emphasizing the central role of parental involvement and parent-mediated interaction in the development of children's communicative competence. Previous evidence has shown that parental involvement can facilitate communication development in children with neurodevelopmental conditions, particularly when parents are trained to respond more consistently and contingently to children's communicative signals (Tenerife et al., 2023). Similarly, systematic evidence regarding parent-training approaches has indicated that structured parental instruction can improve communication, interaction, and language-related outcomes in children with developmental difficulties (Mohammadzadeh et al., 2024). Studies combining behavioral principles, parent training, and modeling have also demonstrated that social communication skills can be strengthened when caregivers become more active and responsive participants in the intervention process (Bordini et al., 2024). Although these studies have frequently focused on autism spectrum disorder, the mechanisms underlying their findings are relevant to children with ADHD because both populations may experience difficulties in reciprocal interaction, responsiveness to social signals, and sustained engagement in communication.

The improvement in communication skills observed in the present study may be explained by several processes embedded within the intervention. Mothers were trained in active listening, reflective responding, emotional validation,

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appropriate eye contact, descriptive commenting, positive reinforcement, and reduction of excessive criticism and commands. These techniques are likely to create a more predictable and supportive communication environment in which children have greater opportunities to initiate, maintain, and repair interactions. For children with ADHD, whose communication may be disrupted by impulsivity, distractibility, and poor self-regulation, a highly responsive parent can provide external structure that supports more organized communication. This explanation is compatible with findings showing that mother–child verbal communication is associated with children's self-regulatory functioning (Yu, 2018). It is also consistent with evidence that mother–child dyadic synchrony can predict improvement in communication and behavior during parent-mediated intervention (Fu et al., 2020). When a mother becomes more sensitive to the child's timing, emotional state, and communicative intent, the interaction is likely to become more coordinated, thereby reducing interruptions, misunderstandings, and escalating exchanges.

The findings regarding communication skills are also supported by studies emphasizing the broader psychological significance of mother–child communication. Communication quality between mothers and children has been associated with psychological well-being and reduced relational conflict (Cho & Han, 2021). Conversely, greater communication apprehension within the mother–child relationship has been linked with lower resilience and self-esteem and higher depressive symptoms later in development (Curran et al., 2020). These findings suggest that communication within the mother–child dyad is not merely a surface-level behavioral process but may function as a fundamental relational resource. In the present study, improving communication likely helped children experience interactions with their mothers as more comprehensible, predictable, and emotionally safe. This may, in turn, have reduced disruptive interaction cycles and supported more adaptive expression of needs and emotions.

The second major finding was that mother–child interaction training significantly improved the quality of the mother–child relationship. This result is consistent with a body of research showing that parental education and structured relational interventions can reduce dysfunctional patterns and improve interaction quality. Problem-solving interventions have been found to enhance mothers' interactions with children who experience communication difficulties (Kakabraee, 2020). Similarly, nonviolent communication training has improved mother–child interaction among mothers of children with intellectual disabilities (Rezaei et al., 2019). Cognitive-based problem-solving interventions have also been associated with improvements in parenting styles and reductions in parental anger (Shokoohi Yekta & Motamed Yeganeh, 2024). More recent skill-oriented interventions have demonstrated beneficial effects on parents' emotional and communicative functioning (Mousavi et al., 2025). Together, these findings support the current result that changes in maternal communication style, emotional responsiveness, and behavior-management strategies can produce measurable improvements in the quality of the mother–child relationship.

The observed improvement in the mother–child relationship may be understood in terms of changes in reciprocal interaction patterns. Families of children with ADHD may become trapped in coercive cycles characterized by repeated commands, noncompliance, frustration, criticism, and emotional escalation. Over time, these cycles can reduce positive shared experiences and increase relational strain. The intervention used in the present study directly targeted these processes by teaching mothers to reinforce desirable behavior, give clear and manageable instructions, reduce unnecessary criticism, use consistent consequences, and increase positive shared activities. Such changes are likely to alter the balance between positive and negative interactions and to increase the child's experience of maternal responsiveness. This interpretation is supported by evidence showing that parenting programs can improve self-efficacy and reduce parenting stress among mothers of children with ADHD (Paknejad et al., 2025). Greater parental self-efficacy may help mothers respond to difficult behavior with greater confidence and consistency rather than frustration or helplessness.

The present findings are also aligned with research on acceptance- and commitment-based parenting interventions in families of children with ADHD. Such interventions have been associated with improvements in parent–child interaction, maternal self-efficacy, and psychological flexibility (Jalilian et al., 2025). Psychological flexibility may be particularly important in the context of ADHD because mothers frequently encounter unpredictable or challenging behavior that can evoke strong negative emotions. A mother who is better able to regulate her own reactions may be less likely to respond harshly and more likely to maintain a supportive and consistent interactional stance. The improvement found in the present study may

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therefore reflect not only changes in overt parenting behavior but also improved maternal emotional regulation and greater tolerance of child-related stress.

The third major finding was that attachment problems significantly decreased in the intervention group. This result is theoretically important because attachment-related functioning depends heavily on repeated experiences of caregiver sensitivity, availability, and responsiveness. When mothers are more attentive to children's emotional signals, respond more predictably, and repair disruptions in interaction, children may develop a stronger sense of relational security. Previous studies have demonstrated close associations between parent–child attachment and children's emotion-regulation abilities (Ferreira et al., 2024). Attachment relationships with parents have also been shown to have transactional associations with broader socioemotional characteristics, including self-compassion (Song et al., 2023). These findings support the interpretation that improvements in maternal responsiveness may reduce children's attachment-related difficulties by increasing emotional security and improving the regulation of distress within the relationship.

The reduction in attachment problems is also consistent with research showing that parenting styles and maternal attachment characteristics are important predictors of child behavioral outcomes. Maternal parenting styles and attachment patterns have been associated with behavioral problems among young children (Yousefi Khaneh Bargh & Zeynali, 2024), and children's attachment styles may mediate associations between maternal parenting and behavioral disturbance (Haji Adineh et al., 2024). In addition, attachment dimensions and maternal reflective functioning have been linked to childhood aggression and other maladaptive outcomes (Talebian Sharif et al., 2023). These findings suggest that attachment problems are not independent of everyday parenting behavior. Rather, they develop and are maintained through recurring interpersonal experiences in which children form expectations regarding whether caregivers will understand, support, and respond to them.

The present intervention may have reduced attachment problems because it encouraged mothers to interpret their children's behavior in a more relational and emotionally sensitive manner. Behaviors associated with ADHD may often be perceived by caregivers as intentional disobedience, lack of motivation, or disrespect. Such interpretations can elicit controlling or punitive responses, which may further increase child distress and relational insecurity. Through training in emotional validation, child-led interaction, sensitive responding, and repair of relational ruptures, mothers may have become more capable of perceiving behavior as a signal of dysregulation rather than deliberate opposition. This change in interpretation may have increased the consistency and sensitivity of maternal responses and reduced the child's need to engage in maladaptive proximity-seeking, avoidance, or defensive behaviors.

The current findings are further supported by studies demonstrating the effectiveness of attachment-oriented interventions. Attachment-based mother training has been associated with improvements in children's social competence and reductions in school refusal (Motevally Joybari et al., 2024). Attachment-based interventions have also been found to reduce anxiety symptoms in children with separation anxiety disorder (Khajeh Goldloo & Farshbaf Manisefat, 2025), while attachment-based play therapy has produced improvements in maternal self-efficacy, emotion regulation, and children's social adjustment (Sadeghi et al., 2025). Attachment-focused therapeutic approaches have also shown beneficial effects on maladaptive maternal cognitive processes (Haghiri et al., 2025). Together, these findings provide empirical support for the present result that strengthening maternal sensitivity and emotional availability may improve attachment-related functioning in children.

The maintenance of gains at the two-month follow-up is another noteworthy finding. Communication skills, mother–child relationship quality, and attachment-related improvements remained relatively stable after the intervention had ended. The absence of statistically significant deterioration from posttest to follow-up suggests that mothers were able to continue using the learned strategies in daily life. One possible explanation is that mother–child interaction training targets naturally recurring behaviors rather than isolated therapeutic exercises. Mothers interact with their children every day, and each interaction provides an opportunity to reinforce the newly acquired skills. Therefore, the home environment may function as an ongoing context for practice and consolidation. Long-term research on attachment-based preventive interventions has similarly indicated that changes in parent–child relational processes can persist over time (Walter et al., 2024). This supports the possibility that interventions targeting relational patterns may produce effects that are maintained beyond the immediate treatment period.

The present findings should also be considered in relation to the broader family context. Parent–child attachment and children's social-emotional competence are influenced by

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patterns of emotional expression and relationships within the family system (Tang et al., 2023). This implies that improvement in one dyadic relationship may have implications beyond the specific mother–child interaction. When mothers become more emotionally responsive, less reactive, and more consistent, the overall emotional climate of the home may become more predictable and less conflictual. Such changes may facilitate children's communication, emotional regulation, and willingness to seek support. This is particularly important for families managing ADHD, where recurrent stress may affect the psychological adjustment of mothers and the quality of family interactions (Mthembu & Ndaba, 2025; Nagase et al., 2024). Therefore, the effects observed in this study may reflect both direct changes in mother–child interaction and broader changes in family emotional functioning.

Overall, the findings suggest that mother–child interaction training can simultaneously influence behavioral, relational, and attachment-related domains in children with ADHD. The convergence of significant findings across communication skills, mother–child relationship quality, and attachment problems is clinically meaningful because these dimensions are interconnected. Communication provides the behavioral channel through which interactions occur, the quality of the mother–child relationship reflects the emotional tone of these exchanges, and attachment represents the child's more enduring expectations about caregiver availability and security. By intervening at the level of daily mother–child interaction, the program may have influenced all three processes at once, thereby producing a coherent pattern of improvement.

The present study has several limitations that should be considered when interpreting the findings. First, the sample was relatively small and consisted of mother–child dyads recruited from psychological and psychiatric centers in Tehran, which may limit the generalizability of the results to other populations, geographical regions, socioeconomic groups, and service settings. Second, several outcome measures relied on maternal reports, which may have introduced shared-method variance and response bias, particularly because mothers were aware of their group assignment. Third, although the control group allowed comparison with participants who did not receive the structured intervention, the study did not include an active comparison condition, making it difficult to determine the extent to which nonspecific factors such as therapist attention, group support, or treatment expectations contributed to the observed improvements. Fourth, the follow-up period was limited to two months and therefore did not permit conclusions regarding the long-term durability of intervention effects. Fifth, the study focused on mothers and did not directly assess the role of fathers or other primary caregivers, even though broader family interactions may influence child communication, attachment, and behavioral functioning.

Future studies should replicate these findings using larger and more diverse samples recruited from multiple clinical, educational, and community settings. Randomized controlled trials with active comparison groups would provide stronger evidence regarding the specific efficacy of mother–child interaction training. Future research should also incorporate multi-informant and multimethod assessments, including father reports, teacher reports, direct behavioral observations, clinician ratings, and objective measures of parent–child interaction. Longer follow-up periods of six months, one year, or more would help determine whether gains remain stable over time. Researchers may also examine mediating mechanisms such as changes in maternal self-efficacy, parenting stress, emotional regulation, reflective functioning, or dyadic synchrony to clarify how the intervention produces its effects. In addition, future studies could investigate whether child age, ADHD presentation, symptom severity, medication status, comorbid conditions, or family structure moderate treatment response.

In practice, clinicians working with children with ADHD should consider incorporating structured mother–child interaction training into comprehensive treatment plans rather than focusing exclusively on the child's symptoms. Training should emphasize active listening, emotional validation, child-led interaction, clear and consistent instructions, positive reinforcement, reduction of criticism, and repair of interactional ruptures. Mental health centers and school-based services may benefit from providing brief parent-training programs that teach caregivers how to respond to inattentive, impulsive, and emotionally dysregulated behaviors without escalating conflict. Periodic booster sessions may help families maintain learned skills and address new developmental challenges. Where possible, fathers and other significant caregivers should also be involved so that the child receives consistent relational and behavioral support across the family environment.

Authors' Contributions

All authors significantly contributed to this study.

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Declaration

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

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the study and participated in the research with informed consent.

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