

Comparison of Social Education Training and Brain-Based Parenting on Adaptability and Social Loneliness in Mothers of Children with Attention-Deficit/Hyperactivity Disorder

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ABSTRACT

The present study aimed to compare the effects of social education training and brain-based parenting on adaptability and social loneliness in mothers of children with attention-deficit/hyperactivity disorder. This was a quasi-experimental study with a pretest–posttest and follow-up design, including two experimental groups and one control group. The statistical population consisted of all children with ADHD aged 7 to 11 years and their mothers. The statistical sample included 60 children and their mothers, who were selected through purposive sampling and randomly assigned to the experimental and control groups. While the control group was placed on a waiting list, the experimental groups received eight 90-minute sessions of social education training and brain-based parenting training. All participants were assessed before, after, and one month after the interventions using the Parenting Adaptability Questionnaire (Yousefi, 2021) and the Social Loneliness Scale developed by DiTommaso et al. (2004). Data were analyzed at two levels: descriptive statistics, including mean and standard deviation, and inferential statistics, including repeated-measures analysis of variance and Bonferroni post hoc test. The results showed that both methods had a significant effect on improving the research variables ($p < .05$), and no significant difference was found between the two methods. Based on these findings, it can be concluded that both methods are effective in improving psychological constructs among mothers of children with ADHD.

Keywords: social education, brain-based parenting, attention-deficit/hyperactivity disorder, adaptability, social loneliness, mothers

1. Introduction

Attention-deficit/hyperactivity disorder is one of the most extensively studied neurodevelopmental disorders of childhood and is characterized by developmentally inappropriate patterns of inattention, hyperactivity, and impulsivity that interfere with academic, social, emotional, and family functioning. Contemporary conceptualizations of ADHD emphasize that the disorder is not limited to behavioral restlessness or poor concentration, but involves complex interactions among neurobiological vulnerability, executive dysfunction, emotional dysregulation, motivational difficulties, sleep problems, and contextual demands within the family and school environment (Faraone et al., 2024). Evidence from developmental and neuropsychological research indicates that children with ADHD often experience impairments in inhibitory control, working memory, planning, sustained attention, delay tolerance, and decision-making, which can make everyday parenting situations more unpredictable and emotionally demanding (Dekkers et al., 2022; Sadozai et al., 2024). In addition, studies on executive functions in ADHD have shown that non-pharmacological interventions can improve cognitive and behavioral regulatory capacities when they are developmentally appropriate and systematically delivered (Qiu et al., 2023). The burden of ADHD is also reflected in long-term developmental outcomes, as recent work has emphasized that diagnosed ADHD may be associated with broader health and life-course risks, making early psychosocial and family-based support especially important (Ophir, 2025). Therefore, although ADHD is often diagnosed in the child, its consequences extend to the parental system, especially mothers who are frequently the primary caregivers and who are directly involved in regulating the child's behavior, emotions, school responsibilities, peer relations, and social participation.

The family context is central to the adjustment of children with ADHD because many of the child's difficulties emerge most clearly in everyday routines, such as homework, sleep preparation, peer interaction, emotional conflict, rule-following, and participation in social situations. Teachers and children themselves report that ADHD-related difficulties in the primary school classroom are not only cognitive but also social and relational, as children may struggle to sustain attention, follow instructions, wait for turns, regulate frustration, and interpret classroom expectations (McDougal et al., 2023). Such difficulties

create continuous demands on parents and may reduce parental confidence, flexibility, and perceived effectiveness. Mothers of children with ADHD are frequently required to shift between monitoring, emotional containment, behavioral guidance, school communication, and social coaching. When these demands are chronic, parenting may become rigid, reactive, or avoidant. In this context, parenting adaptability becomes a critical psychological construct. Parenting adaptability refers to the parent's capacity to respond flexibly to the child's developmental needs, regulate parenting strategies according to situational demands, maintain constructive involvement, and revise ineffective responses rather than repeating coercive or inconsistent patterns. For mothers of children with ADHD, adaptability is especially important because the child's behavior may vary across situations and may require rapid adjustment between structure, empathy, limit-setting, emotional validation, and social guidance.

Alongside challenges in parenting adaptability, social loneliness is another important psychological difficulty among mothers of children with ADHD. Social loneliness is not merely the absence of social contacts; rather, it reflects perceived insufficiency in meaningful social belonging, support, and relational integration. Mothers who care for children with ADHD may experience social isolation because of stigma, repeated complaints from schools or relatives, embarrassment in public settings, reduced opportunity for leisure and social contact, and the emotional fatigue associated with constant behavioral management. Sleep difficulties, which are strongly associated with ADHD symptoms in children, may intensify family stress and reduce mothers' opportunities for rest, emotional recovery, and social engagement (Yin et al., 2022). When the child's impulsivity, emotional reactivity, or social difficulties lead to conflict with peers and adults, mothers may gradually withdraw from family gatherings, school-related interactions, or community activities. This withdrawal can increase loneliness and reduce access to social support, thereby weakening parenting resilience. Consequently, interventions for families of children with ADHD should not focus solely on reducing child symptoms, but should also strengthen mothers' psychological resources, parenting flexibility, and social-emotional functioning.

Pharmacological treatment is one of the established components of ADHD management, and methylphenidate has been widely examined as a treatment for children and adolescents with ADHD (Storebo et al., 2023). However, pharmacological approaches alone do not fully address the

relational, educational, emotional, and parenting challenges experienced in daily family life. Evidence-based psychosocial interventions remain necessary because ADHD-related impairment is context-dependent and frequently requires changes in parental responses, classroom practices, behavioral expectations, emotional regulation strategies, and social skill development (Evans et al., 2024). Current perspectives increasingly emphasize that psychosocial interventions must be made more effective, accessible, and responsive to real-world family and school contexts (Evans et al., 2024). Non-pharmacological interventions targeting executive functions, self-regulation, social competence, and emotional control are therefore especially relevant for children with ADHD and their families (Qiu et al., 2023). In addition, neurofeedback and other brain-oriented interventions have been explored as methods for improving attentional and self-regulatory processes, reflecting growing interest in interventions that translate neurodevelopmental knowledge into practical training models (Kuznetsova et al., 2023). This broader movement provides a foundation for brain-based parenting programs that help parents understand the child's behavior in relation to brain development, integration, emotional arousal, memory, and social cognition.

Brain-based parenting is grounded in the assumption that parents can respond more effectively when they understand the child's behavior through the lens of brain development and neuropsychological functioning. In families of children with ADHD, many disruptive behaviors may be misinterpreted as intentional disobedience, laziness, disrespect, or lack of motivation. A brain-based approach can reframe these behaviors as expressions of immature self-regulation, weak inhibitory control, emotional overload, poor integration between cognitive and affective systems, or difficulty shifting from reactive to reflective states. This reframing may reduce parental blame and increase strategic flexibility. The relevance of this approach is supported by research emphasizing the neurodevelopmental and executive-function foundations of ADHD (Faraone et al., 2024; Sadozai et al., 2024). Studies on specific cognitive and perceptual interventions also show that targeted training can improve underlying functions associated with ADHD, such as attention, inhibition, visual perception, and depth perception (Sarvarian et al., 2023; Shadfar et al., 2023). Similarly, mentalization-based drama therapy has been found to improve sustained attention in children with ADHD, suggesting that interventions integrating cognitive, emotional, and social understanding may be useful in this

population (Kaboli et al., 2023). Therefore, training mothers to interpret behavior through neurodevelopmental principles may enhance parenting adaptability by helping them select responses that fit the child's regulatory capacity rather than relying on punishment, criticism, or inconsistent control.

Mindfulness-based and self-regulation-oriented interventions have also become increasingly prominent in the field of ADHD and related child psychological difficulties. Systematic reviews indicate that mindfulness programs can have beneficial effects for children and adolescents with ADHD, particularly in relation to attention, self-regulation, and emotional functioning (Kretschmer et al., 2022; Sultan et al., 2025). Child-centered mindfulness skills training has been shown to improve self-control and social competence in children with ADHD, highlighting the relevance of interventions that cultivate awareness, inhibition, and reflective responding (Keshavarz Valian et al., 2022). Other studies have demonstrated the effectiveness of child-centered mindfulness in improving attention and response inhibition among students with dysgraphia, and in reducing social isolation and improving emotion regulation in children with specific learning disorder, indicating that mindfulness-based components may be transdiagnostically useful for children with self-regulatory and social-emotional problems (Rashidi Ahmadabadi et al., 2024; Sarvarian et al., 2023). Moreover, mindfulness-based interventions have been compared with play-based methods in elementary school students, with findings supporting their role in enhancing social skills and creativity (Giloni et al., 2024). Such findings are important for the present study because brain-based parenting commonly includes mindful awareness, focused attention, recognition of internal states, and reflective interpretation of behavior, all of which may help mothers regulate their own reactions and reduce interpersonal withdrawal.

Play-based, child-centered, and emotion-regulation interventions also provide an important empirical background for the present study. Child-centered play therapy has been shown to improve executive functions in children with ADHD, suggesting that developmentally sensitive interventions can influence the regulatory processes central to ADHD symptoms (Wong et al., 2023). Similarly, executive-function-based play therapy and child-centered mindfulness have been compared in children with ADHD, with attention to cognitive emotion regulation as an outcome (Babaei Mahdiah et al., 2025). Cognitive-behavioral play therapy has also been reported to improve resilience and emotion regulation in children with ADHD

(Karoubi, 2023). Beyond ADHD, emotional regulation play therapy has been used with maltreated children, underscoring the role of play-oriented and emotion-focused methods in strengthening children's adaptive capacities (Benu, 2023). Child-centered play therapy has also demonstrated effects on mindful expression and social-emotional competencies among preschool children (Robinson et al., 2024). In Iranian research, play therapy has been found effective in improving emotion regulation, social competencies, and resilience in children with social anxiety, and in improving emotion regulation and social adjustment among students dependent on online games (Darakhsh et al., 2024; Esmaeili Shahna & Rahmanian, 2025). Although these interventions often target children directly, their findings support the broader principle that social-emotional development, regulation, and adaptive behavior can be improved through structured psychosocial training. For mothers, learning how to support these processes through parenting may increase adaptability and reduce the sense of helplessness that contributes to loneliness.

Social education training represents another relevant intervention pathway. Children with ADHD frequently face social difficulties due to impulsive responding, poor turn-taking, emotional reactivity, weak frustration tolerance, and difficulty understanding social consequences. These challenges can interfere with peer acceptance and family functioning, but they also place mothers in a position of continuous social mediation. Social education in parenting focuses on helping parents understand socialization needs, teach cooperation and responsibility, support emotional management, strengthen discipline without damaging self-esteem, and create conditions for constructive participation in family and community life. Research on self-regulation strategy training has shown beneficial effects on attention deficit, social adjustment, and self-efficacy in children with ADHD, indicating that interventions targeting behavioral regulation and social functioning are relevant for this population (Shahi et al., 2024). Dialectical behavior therapy has also been found effective in improving academic emotion components and self-control among students with ADHD, further emphasizing the role of emotion regulation and adaptive behavioral skills (Sadeghi, 2023). In addition, studies on social anxiety, social competencies, and social isolation show that interventions addressing social-emotional capacities can reduce isolation and enhance adjustment (Rashidi Ahmadabadi et al., 2024; Zare Nejad et al., 2024). Therefore, social education training for mothers of children with ADHD may improve parenting adaptability

by equipping mothers with practical strategies for guiding responsibility, cooperation, turn-taking, emotional communication, and social behavior.

The comparison of social education training and brain-based parenting is theoretically important because these two approaches may operate through different but complementary mechanisms. Social education training primarily emphasizes the child's socialization, behavioral discipline, cooperation, emotional management, and responsible participation in interpersonal contexts. Brain-based parenting, by contrast, emphasizes understanding the child's behavior through neurodevelopmental mechanisms, brain integration, emotional arousal, memory systems, mindsight, and social cognition. Both approaches may improve parenting adaptability, but social education may do so by expanding mothers' behavioral and social guidance strategies, whereas brain-based parenting may do so by changing mothers' interpretation of child behavior and improving reflective response patterns. Both may also reduce social loneliness, because mothers who feel more competent and flexible in parenting may experience less shame, avoidance, and perceived social disconnection. Genetic and epidemiological findings indicate that ADHD is linked to a broad range of exposures and outcomes, supporting the need for multifaceted approaches rather than single-domain explanations or interventions (Soler Artigas et al., 2023). Accordingly, comparing two structured parenting-oriented educational programs can clarify whether different psychosocial pathways produce similar benefits for maternal psychological outcomes.

Despite the growing literature on child-focused interventions for ADHD, fewer studies have directly compared parent-oriented educational approaches in relation to mothers' parenting adaptability and social loneliness. Existing evidence supports the effectiveness of mindfulness, play therapy, self-regulation training, executive-function interventions, neurofeedback, and social-emotional programs in children with ADHD or related difficulties (Kuznetsova et al., 2023; Qiu et al., 2023; Sultan et al., 2025; Wong et al., 2023). However, mothers' psychological functioning remains an essential but sometimes underemphasized outcome. A mother who becomes more adaptable in parenting may be better able to manage behavioral challenges, preserve emotional connection, support the child's social development, and maintain her own psychological well-being. Similarly, reducing social loneliness may improve maternal support-seeking, emotional resilience, and sustained engagement in the

parenting role. Since ADHD creates persistent demands across home, school, and social environments, interventions that strengthen mothers' competence and connectedness may have broader developmental value for both mothers and children.

The aim of the present study was to compare the effectiveness of social education training and brain-based parenting on parenting adaptability and social loneliness among mothers of children with attention-deficit/hyperactivity disorder.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a quasi-experimental design with a pretest–posttest control-group structure and a 45-day follow-up phase. The statistical population consisted of mothers of children aged 7 to 11 years who showed symptoms of attention-deficit/hyperactivity disorder. Because the study was quasi-experimental, and based on methodological recommendations for intervention studies, a sample size of 20 participants per group was considered adequate. Accordingly, 60 mothers of children aged 7 to 11 years with symptoms of hyperactivity were selected through purposive sampling from among cases introduced by school authorities. After obtaining the required permission from the university and coordinating with the Department of Education, participants were screened according to the inclusion and exclusion criteria and then randomly assigned to two experimental groups and one control group, with 20 participants in each group. The inclusion criteria for mothers were having a child aged 7 to 11 years with symptoms of hyperactivity according to the school health record, willingness to participate in the educational program, commitment to regular attendance in the training sessions as far as possible, not participating in any parallel parenting education program, and obtaining an above-average score on the hyperactivity subscale of the behavioral disorders measure developed by Achenbach (1998). The exclusion criteria were absence from more than two training sessions and voluntary withdrawal from the sessions during the program or at any other stage of the study. After group assignment, all participants completed the pretest. The two experimental groups then received the relevant training programs, whereas the control group remained on a waiting list. At the end of the intervention and again 45 days later, all participants were reassessed using the research instruments. The training sessions were conducted once a

week during winter in a counseling center in Shiraz by the researcher. To reduce participant attrition, the group rules and the rationale for regular and consecutive attendance were explained to participants at the beginning of the program. Except for two mothers, none of the participants had more than one absence. Educational materials and worksheets related to each session were also provided to the mothers for further study and practice.

2.2. Measures

The Parenting Adaptability Questionnaire was originally developed by Yousefi et al. (2011). This questionnaire includes five subscales: concern, control, curiosity, confidence, and commitment. Each dimension contains four items, and the items are scored on a five-point Likert scale ranging from strongly agree to strongly disagree. In the study by Mirzaei et al. (2024), the items were adapted to the context of parenting. After adaptation, the internal consistency of the questionnaire was re-examined using Cronbach's alpha and was reported as .90. Test–retest reliability was also assessed, and the Pearson correlation coefficient was significant, $r = .45$, $p = .001$, indicating acceptable temporal stability. The results of confirmatory factor analysis supported the five-factor structure of the questionnaire, confirming its construct validity. In addition, the questionnaire scores showed a positive correlation with parenting self-efficacy and a significant association with parenting stress, supporting its convergent validity. In the study by Mirzaei et al. (2024), internal consistency assessed through Cronbach's alpha was reported to be above .80. In the present study, the internal consistency coefficient of this questionnaire was calculated as .91.

The Social Loneliness Questionnaire was developed by DiTommaso et al. (2004) to assess adults' social and emotional loneliness. This instrument consists of 14 items and three components, including romantic loneliness, family loneliness, and social loneliness. The items are scored on a five-point Likert scale ranging from strongly agree to strongly disagree. The internal consistency of the questionnaire has been reported by experts as .80. Amorim et al. (2019) examined and confirmed the construct validity of the questionnaire using exploratory and confirmatory factor analyses, and the internal consistency coefficients in their study were reported to be above .80. In Iran, Jokar and Salimi (2011) examined and confirmed the convergent and discriminant validity of the questionnaire through its associations with life satisfaction and perceived social

support measures. Factor analysis in their study also supported the three-dimensional structure of the instrument. In the present study, the internal consistency coefficient of this questionnaire was calculated as .81.

2.3. Interventions

The social education parenting program for mothers of children with ADHD was implemented in eight structured sessions. In the first session, mothers were introduced to the symptoms of hyperactivity and methods for managing these symptoms, and they completed a worksheet for monitoring parenting-related problems in relation to their child's hyperactivity. In the second session, mothers became familiar with parenting, different parenting styles, the advantages and disadvantages of each style, and the most appropriate parenting approach for children with hyperactivity; the related assignment involved monitoring their own parenting style. In the third session, social education was introduced as an important element in organizing parenting content, and mothers learned about social education components and the socialization problems experienced by children with hyperactivity. In the fourth session, the concept and dimensions of social education were further explained, and mothers were asked to identify the domains in which they needed to invest more time and energy for their child. In the fifth session, mothers learned about the requirements and principles of social education for children with hyperactivity and completed a worksheet on the principles of social education in parenting. In the sixth session, the emphasis was placed on the specific requirements of social education for children with hyperactivity and on strengthening self-esteem in these children. In the seventh session, mothers were trained in ways of promoting discipline, responsibility, turn-taking, cooperation, and participation in their children while preserving the child's self-esteem. In the eighth session, the role of emotions and emotion management in children's social education was discussed, and mothers learned how to support their children in understanding and managing emotions through emotion-focused parenting practices.

The brain-based parenting training protocol was based on the program introduced by Motavalli et al. (2025) and derived from Karimi et al. (2024). This protocol was also delivered in eight sessions. The first session focused on initial acquaintance, therapeutic alliance, explanation of the overall educational program, the importance of appropriate parenting, administration of the pretest, identification of

mothers' main concerns about parenting and their children, and clarification of the goals of brain-based parenting. The second session addressed the role and importance of the brain and its structure in parenting, including the physiology and structure of the human brain, brain integration, and the concepts of chaos and rigidity in parent-child interactions. The third session focused on the left and right hemispheres of the brain, their functions in daily life, and the role of left-right brain integration in resolving parenting challenges. The fourth session explained the upper and lower regions of the brain, their functions, and the importance of integrating these regions in managing parenting-related difficulties. The fifth session introduced explicit and implicit memory and their role in parenting problems, corrected misconceptions about the brain, and presented strategies for integrating explicit and implicit memory in both children and parents. The sixth session focused on different dimensions of human functioning and their integration, including mindsight, mindfulness, the distinction between feeling and being, focused attention, and strategies for strengthening mindsight in children and parents. The seventh session addressed the integration of the self with others, the development of the capacity to understand others' thoughts, the social brain, mirror neurons, and strategies for helping children establish more adaptive social relationships. The eighth session was devoted to reviewing previous content, summarizing the training program, answering participants' questions, and administering the posttest, while mothers were also encouraged to continue using the learned strategies as ongoing parenting assignments.

2.4. Data Analysis

Data were analyzed at both descriptive and inferential levels. At the descriptive level, mean and standard deviation were calculated for the research variables across the pretest, posttest, and follow-up phases in the three groups. At the inferential level, repeated-measures analysis of variance was used to examine within-group changes over time, between-group differences, and the interaction effect of time and group for parenting adaptability and social loneliness. When significant effects were observed, the Bonferroni post hoc test was used to compare measurement stages and determine the pattern of change from pretest to posttest and follow-up. The significance level was set at .05 for all statistical analyses.

3. Findings and Results

A total of 428 young adults with intellectual disabilities participated in the study. The mean age of the participants was 24.31 years ($SD = 3.42$), with ages ranging from 18 to 30 years. Among the participants, 238 (55.6%) were male and 190 (44.4%) were female. Regarding educational attainment, 127 participants (29.7%) had completed secondary education, 198 (46.3%) had completed vocational training programs, and 103 (24.1%) had attended post-

secondary transition programs. In terms of employment status, 172 participants (40.2%) were engaged in supported employment, 146 (34.1%) worked in competitive employment settings, and 110 (25.7%) were enrolled in vocational preparation programs. The average duration of employment experience was 2.87 years ($SD = 1.54$). Demographic analyses indicated that the sample represented a diverse range of vocational backgrounds and family circumstances, providing an appropriate basis for evaluating predictors of vocational success.

Table 1

Mean and Standard Deviation of Parenting Adaptability and Social Loneliness Across Groups and Measurement Stages

Variable	Stage	SE M	SE SD	BBP M	BBP SD	Control M	Control SD
Parenting adaptability	Pretest	58.75	6.95	57.95	6.09	58.75	5.33
Parenting adaptability	Posttest	72.30	8.86	69.75	7.46	59.05	4.96
Parenting adaptability	Follow-up	72.10	8.05	70.75	7.96	58.75	5.13
Social loneliness	Pretest	58.25	4.96	60.00	2.97	56.30	5.05
Social loneliness	Posttest	45.95	5.16	51.40	3.31	56.65	5.23
Social loneliness	Follow-up	45.05	5.34	50.35	3.19	58.30	8.84

As shown in Table 1, the mean score of parenting adaptability increased from pretest to posttest and remained relatively stable at follow-up in both experimental groups, whereas the control group showed no meaningful change across the three stages. For social loneliness, the mean scores decreased in both experimental groups from pretest to posttest and remained lower at follow-up, while the control group did not show a comparable reduction. These descriptive findings indicate that both social education training and brain-based parenting were associated with improvement in parenting adaptability and reduction in social loneliness among mothers of children with ADHD.

Before conducting the repeated-measures analysis of variance, the statistical assumptions were examined. The

Shapiro–Wilk test indicated that the distributions of parenting adaptability and social loneliness scores were normal across the pretest, posttest, and follow-up stages, with all significance values greater than .05. Levene’s test showed that the assumption of homogeneity of error variances was met for both variables across the study groups, with all significance values greater than .05. Box’s M test was also nonsignificant for both parenting adaptability and social loneliness, indicating equality of the variance–covariance matrices. However, Mauchly’s test of sphericity was significant for both parenting adaptability and social loneliness, indicating that the sphericity assumption was violated. Therefore, the Greenhouse–Geisser correction was applied in the final repeated-measures ANOVA results.

Table 2

Repeated-Measures Analysis of Variance for Parenting Adaptability and Social Loneliness

Variable	Effect	Source	SS	df	MS	F	p	Partial η^2	Power
Parenting adaptability	Within-group	Time	2868.21	1.20	2371.56	283.91	< .001	.833	1.00
Parenting adaptability	Within-group	Time $\times$ Group	1401.956	2.41	579.59	69.38	< .001	.709	1.00
Parenting adaptability	Within-group	Error(Time)	575.83	68.93	8.53	—	—	—	—
Parenting adaptability	Between-group	Group	2615.24	2	1307.62	9.86	< .001	.207	.979
Parenting adaptability	Between-group	Error	7552.81	57	132.50	—	—	—	—
Social loneliness	Within-group	Time	2176.01	1.21	1797.81	158.40	< .001	.735	1.00
Social loneliness	Within-group	Time $\times$ Group	896.65	2.42	395.35	31.65	< .001	.526	1.00
Social loneliness	Within-group	Error(Time)	783.00	68.99	11.34	—	—	—	—
Social loneliness	Between-group	Group	1677.81	2	833.90	3.61	.033	.113	.646
Social loneliness	Between-group	Error	13133.05	57	230.40	—	—	—	—

As shown in Table 2, for parenting adaptability, the within-group effect of time was statistically significant, $F(1.20, 68.93) = 283.91$, $p < .001$, partial $\eta^2 = .833$, indicating significant changes in parenting adaptability across the three measurement stages. The interaction effect of time and group was also statistically significant, $F(2.41, 68.93) = 69.38$, $p < .001$, partial $\eta^2 = .709$, showing that the pattern of change over time differed significantly among the social education, brain-based parenting, and control groups. In addition, the between-group effect was significant, $F(2, 57) = 9.86$, $p < .001$, partial $\eta^2 = .207$, indicating that the

groups differed significantly in parenting adaptability. For social loneliness, the effect of time was statistically significant, $F(1.21, 68.99) = 158.40$, $p < .001$, partial $\eta^2 = .735$, and the time $\times$ group interaction was also significant, $F(2.42, 68.99) = 31.65$, $p < .001$, partial $\eta^2 = .526$. The between-group effect for social loneliness was significant as well, $F(2, 57) = 3.61$, $p = .033$, partial $\eta^2 = .113$. These results indicate that both interventions were effective in improving parenting adaptability and reducing social loneliness compared with the control condition.

Table 3

Bonferroni Post Hoc Comparisons for Parenting Adaptability and Social Loneliness Across Groups and Measurement Stages

Variable	Stage	Reference Group	Comparison Group	Mean Difference	SE	p
Parenting adaptability	Pretest	Social education	Brain-based parenting	0.80	1.95	.683
Parenting adaptability	Pretest	Social education	Control	2.28	1.95	1.000
Parenting adaptability	Pretest	Brain-based parenting	Control	0.807	1.95	1.000
Parenting adaptability	Posttest	Social education	Brain-based parenting	2.55	2.30	.273
Parenting adaptability	Posttest	Social education	Control	13.25	2.30	.001
Parenting adaptability	Posttest	Brain-based parenting	Control	10.70	2.30	.001
Parenting adaptability	Follow-up	Social education	Brain-based parenting	2.35	2.27	.305
Parenting adaptability	Follow-up	Social education	Control	13.35	2.27	.001
Parenting adaptability	Follow-up	Brain-based parenting	Control	11.00	2.27	.001
Social loneliness	Pretest	Social education	Brain-based parenting	-0.150	2.63	.955
Social loneliness	Pretest	Social education	Control	-0.200	2.63	.940
Social loneliness	Pretest	Brain-based parenting	Control	-0.050	2.63	.955
Social loneliness	Posttest	Social education	Brain-based parenting	-3.00	2.92	.919
Social loneliness	Posttest	Social education	Control	9.30	2.92	.002
Social loneliness	Posttest	Brain-based parenting	Control	9.60	2.92	.002
Social loneliness	Follow-up	Social education	Brain-based parenting	-1.10	2.98	.714
Social loneliness	Follow-up	Social education	Control	9.45	2.98	.002
Social loneliness	Follow-up	Brain-based parenting	Control	10.55	2.98	.001

As shown in Table 3, no significant difference was observed among the three groups at the pretest stage in either parenting adaptability or social loneliness, indicating that the groups were comparable before the interventions. At the posttest stage, both the social education and brain-based parenting groups differed significantly from the control group in parenting adaptability, whereas the difference between the two experimental groups was not significant. The same pattern was observed at follow-up, showing that the intervention effects on parenting adaptability remained stable 45 days after the end of training. For social loneliness, both experimental groups showed significant differences from the control group at posttest and follow-up, whereas the difference between the social education and brain-based parenting groups was not significant at either stage. Therefore, both interventions were effective in improving parenting adaptability and reducing social loneliness among

mothers of children with ADHD, and their effects were maintained at the follow-up stage.

4. Discussion

The present study aimed to compare the effectiveness of social education training and brain-based parenting on parenting adaptability and social loneliness among mothers of children with attention-deficit/hyperactivity disorder. The findings showed that both interventions significantly improved parenting adaptability from pretest to posttest, and these gains were maintained at follow-up. In addition, both interventions significantly reduced social loneliness among mothers, and the reduction remained stable at the follow-up stage. The Bonferroni post hoc comparisons indicated that both the social education and brain-based parenting groups differed significantly from the control group at posttest and

follow-up, whereas no significant difference was found between the two experimental groups. Therefore, both approaches can be considered effective educational interventions for strengthening maternal adaptability and reducing social loneliness in mothers of children with ADHD. These findings are consistent with the broader literature indicating that ADHD is a multidimensional neurodevelopmental condition that affects not only the child's attention and behavior but also the emotional, social, and relational functioning of the family system (Evans et al., 2024; Faraone et al., 2024). Because children with ADHD often experience impairments in executive functions, inhibitory control, emotional regulation, and social adjustment, mothers may face repeated parenting challenges that require flexibility, emotional containment, and adaptive problem-solving (Dekkers et al., 2022; Sadozai et al., 2024). The improvement observed in parenting adaptability in the present study suggests that structured parent education can help mothers move from reactive and rigid responses toward more reflective, flexible, and developmentally appropriate parenting strategies.

The effectiveness of social education training in improving parenting adaptability can be explained by the content and structure of the intervention. This program introduced mothers to the symptoms of hyperactivity, appropriate parenting styles, the principles of social education, the socialization needs of children with ADHD, responsibility, turn-taking, cooperation, discipline, self-esteem, and emotion management. Such content directly addresses the everyday behavioral and interpersonal problems that mothers of children with ADHD encounter. Children with ADHD frequently struggle in classroom and peer contexts because of impulsivity, difficulty waiting, poor rule-following, and inconsistent attention, and these difficulties can place mothers under continuous pressure to correct, explain, defend, and manage the child's social behavior (McDougal et al., 2023). By learning how to support socialization, emotional expression, cooperation, and discipline without damaging the child's self-worth, mothers may become more capable of selecting strategies that fit the child's actual needs rather than responding through blame, frustration, or avoidance. This interpretation is aligned with research showing that self-regulation strategy training can improve attention deficit, social adjustment, and self-efficacy in children with ADHD (Shahi et al., 2024). It is also consistent with findings that social-emotional and play-based interventions can improve social competencies, emotion regulation, resilience, and social adjustment in

children with psychological or developmental difficulties (Darakhsh et al., 2024; Esmaeili Shahna & Rahmanian, 2025; Robinson et al., 2024). Although these studies primarily focused on children, their findings support the assumption that structured training in social and emotional domains can reduce behavioral chaos and indirectly strengthen parental competence.

The effect of social education training on reducing social loneliness among mothers can also be understood in relation to the social consequences of parenting a child with ADHD. Mothers of children with ADHD may gradually experience social withdrawal due to stigma, repeated criticism from school or relatives, embarrassment in public situations, and exhaustion from managing the child's behavior. When mothers acquire clearer strategies for guiding their child's social behavior, emotional responses, and cooperative participation, they may feel less helpless and less isolated. The reduction in social loneliness in the social education group suggests that improving parenting competence may have benefits beyond parenting behavior itself and may influence mothers' sense of social connectedness. This finding is indirectly supported by studies showing that interventions targeting social competence, emotion regulation, and social isolation can improve interpersonal functioning in children with related psychological difficulties (Rashidi Ahmadabadi et al., 2024; Zare Nejad et al., 2024). In addition, the effectiveness of play therapy and mindfulness-based approaches on social skills and creativity among elementary school students suggests that social-emotional capacities are malleable and responsive to structured intervention (Giori et al., 2024). When mothers perceive that their child's social behavior is more understandable and manageable, they may become more willing to participate in social interactions and less likely to avoid family, school, or community settings.

The findings also showed that brain-based parenting significantly improved parenting adaptability. This result can be explained by the fact that brain-based parenting helps mothers reinterpret children's behavior through the lens of brain development, neural integration, emotional arousal, memory systems, mindfulness, mindsight, and social cognition. Mothers of children with ADHD may often perceive the child's behavior as intentional disobedience or lack of respect, which can intensify negative emotional reactions and reduce parenting flexibility. Brain-based parenting can modify this interpretation by emphasizing that impulsivity, emotional dysregulation, disorganization, and poor inhibition are partly rooted in neurodevelopmental and

executive-function limitations. This explanation is consistent with the literature showing that ADHD is closely associated with deficits in executive functioning, inhibitory control, attention, and decision-making (Qiu et al., 2023; Sadozai et al., 2024). The finding is also aligned with studies indicating that interventions targeting executive functions and neurocognitive processes can improve functioning in children and adolescents with ADHD (Kuznetsova et al., 2023; Wong et al., 2023). When mothers understand the child's behavior as a regulatory difficulty rather than merely oppositional behavior, they may respond with more structure, empathy, and strategic flexibility, which can explain the observed improvement in parenting adaptability.

The reduction of social loneliness in the brain-based parenting group may be related to the intervention's emphasis on self-awareness, mindfulness, parent-child connection, and understanding the social brain. The protocol included concepts such as focused attention, mindsight, mindfulness, mirror neurons, self-other integration, and the development of the child's capacity to understand others. These concepts can help mothers become more reflective about their own emotional reactions and more sensitive to the child's internal states. Such reflective parenting may reduce guilt, shame, and interpersonal withdrawal, because mothers may feel more competent and less personally responsible for every behavioral difficulty. This interpretation is supported by systematic reviews showing that mindfulness interventions can benefit children and adolescents with ADHD and may improve attention, self-regulation, and emotional functioning (Kretschmer et al., 2022; Sultan et al., 2025). It is also consistent with evidence that child-centered mindfulness can improve self-control, social competence, attention, response inhibition, and emotion regulation in children with ADHD or related learning and emotional difficulties (Keshavarz Valian et al., 2022; Rashidi Ahmadabadi et al., 2024; Sarvarian et al., 2023). Although the present study focused on mothers rather than children, the findings suggest that mindfulness-informed and brain-informed parenting education may enhance mothers' emotional regulation and reduce the interpersonal burden associated with raising a child with ADHD.

The absence of a significant difference between social education training and brain-based parenting is another important finding. This result suggests that both interventions may operate through different but equally effective pathways. Social education training appears to improve maternal adaptability by equipping mothers with

concrete behavioral and socialization strategies, whereas brain-based parenting appears to improve adaptability by changing mothers' understanding of the child's behavior and strengthening reflective, neurodevelopmentally informed responses. Despite these different mechanisms, both approaches may reduce maternal uncertainty and enhance perceived control. This interpretation is consistent with the current movement in ADHD intervention research, which emphasizes the need for multiple evidence-based psychosocial approaches rather than reliance on a single treatment model (Evans et al., 2024). Although pharmacological treatments such as methylphenidate remain important in ADHD management, psychosocial interventions are essential because medication alone cannot address parenting stress, social functioning, emotional communication, and family adaptation (Storebo et al., 2023). Moreover, the multifactorial nature of ADHD, including genetic, neurodevelopmental, behavioral, emotional, and environmental correlates, supports the use of diverse intervention models that target different levels of functioning (Ophir, 2025; Soler Artigas et al., 2023). Therefore, the similarity between the two interventions in the present study does not indicate weakness; rather, it suggests that both are meaningful and clinically useful pathways for supporting mothers of children with ADHD.

The maintenance of intervention effects at follow-up further strengthens the practical value of the findings. In both experimental groups, improvements in parenting adaptability and reductions in social loneliness remained stable after the end of the sessions. This indicates that the programs may have produced changes beyond temporary emotional relief. The use of worksheets, home assignments, weekly practice, and repeated review may have helped mothers transfer the content of the sessions into daily parenting situations. This is consistent with previous studies showing that structured interventions, including cognitive-behavioral play therapy, dialectical behavior therapy, mindfulness-based training, and child-centered therapeutic methods, can produce meaningful improvements in resilience, emotion regulation, self-control, and adaptive functioning when they include repeated practice and skill consolidation (Babaei Mahdieh et al., 2025; Karoubi, 2023; Sadeghi, 2023). Similarly, research on emotional regulation play therapy and child-centered play therapy supports the idea that structured, relationship-based intervention can improve regulation and social-emotional functioning (Benu, 2023; Robinson et al., 2024). The stability of the results in

the present study may therefore reflect the applied and practice-oriented nature of both training protocols.

The findings also have theoretical implications for understanding maternal psychological functioning in the context of ADHD. ADHD-related impairments are often discussed in relation to the child's academic performance, executive functioning, and social behavior, but the present results show that maternal outcomes are equally important. Mothers' adaptability and loneliness are not secondary or marginal issues; they may shape the quality of parenting, the emotional climate of the family, and the child's opportunity for improvement. Research on visual perception exercises, mentalization-based drama therapy, neurofeedback, and executive-function interventions demonstrates that ADHD-related difficulties can be addressed through targeted, mechanism-informed interventions (Kaboli et al., 2023; Kuznetsova et al., 2023; Qiu et al., 2023; Shadfar et al., 2023). The present study extends this perspective by showing that mothers can also benefit from structured psychoeducational interventions that either focus on social education or brain-based understanding. In other words, improving the caregiving environment may be as important as directly improving the child's symptoms. Since mothers often mediate the child's relationship with school, peers, relatives, and treatment providers, increasing their adaptability may create broader developmental benefits for the child and family system.

5. Conclusion

Overall, the results of this study support the effectiveness of both social education training and brain-based parenting in improving parenting adaptability and reducing social loneliness among mothers of children with ADHD. These findings align with previous research emphasizing the efficacy of psychosocial, mindfulness-based, play-based, self-regulation-oriented, and neurodevelopmentally informed interventions for children with ADHD and related difficulties (Keshavarz Valian et al., 2022; Shahi et al., 2024; Sultan et al., 2025; Wong et al., 2023). The present study contributes to this literature by focusing specifically on mothers and by comparing two parent-oriented training approaches. The findings suggest that when mothers receive structured education, practical strategies, and a coherent framework for understanding and managing their child's difficulties, they become more adaptable and experience less social loneliness. Therefore, both interventions can be considered suitable options for family-centered

psychological and educational services for children with ADHD.

This study had several limitations that should be considered when interpreting the findings. First, the sample consisted only of mothers of children aged 7 to 11 years with symptoms of ADHD, which limits the generalizability of the findings to fathers, other caregivers, children in different age groups, and families with different cultural or socioeconomic backgrounds. Second, participants were selected through purposive sampling and were introduced through schools, which may have led to the inclusion of mothers who were more motivated to participate in educational interventions. Third, the study relied on self-report questionnaires, and mothers' responses may have been influenced by social desirability, personal expectations, or increased awareness after training. Fourth, the follow-up period was limited to 45 days, and it is not clear whether the effects would remain stable over longer periods. Finally, the study examined maternal outcomes but did not directly assess changes in children's behavioral symptoms, school functioning, or peer relationships.

Future studies should replicate this research with larger and more diverse samples, including fathers, grandparents, and other primary caregivers, to determine whether the findings apply to broader family systems. It is also recommended that future research use randomized controlled trials with longer follow-up periods, such as three months, six months, and one year, to evaluate the durability of intervention effects. Future studies should include multi-informant assessments, such as reports from teachers, children, and clinicians, along with behavioral observations of parent-child interaction. It would also be valuable to examine mediating variables, such as parenting stress, parental self-efficacy, emotion regulation, perceived social support, and child behavioral improvement, to clarify the mechanisms through which social education and brain-based parenting influence maternal adaptability and loneliness. Comparative studies could also evaluate whether combining the two approaches produces stronger effects than using either intervention alone.

Based on the findings, counselors, school psychologists, child therapists, and family educators can use both social education training and brain-based parenting as practical interventions for mothers of children with ADHD. Social education training may be especially useful when mothers need concrete strategies for managing responsibility, cooperation, discipline, turn-taking, emotional expression, and social behavior. Brain-based parenting may be

especially helpful when mothers misinterpret the child's behavior as intentional disobedience or when they need a more reflective and developmentally informed understanding of ADHD-related difficulties. Schools and counseling centers can offer these programs in group formats to reduce cost, increase peer support among mothers, and decrease feelings of isolation. Practitioners should also provide worksheets, home assignments, and follow-up sessions so that mothers can continue applying the learned strategies in real parenting situations.

Authors' Contributions

Authors equally contributed to this article.

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

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The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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