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The Effectiveness of the Floortime Method on Sensory Processing Sensitivity, Theory of Mind, and Social Skills in Children with High-Functioning Autism

Farideh Rahpeymay Nargesi[1], Mohamadparsa Azizi[2*], Fateme Baghermoradi[1], Majid Ebrahimpour[2]

1. M.A. in Exceptional Children Psychology, Sr.C., Islamic Azad University, Tehran, Iran
2. Assistant Professor, Department of Exceptional Children Psychology, Sr.C., Islamic Azad University, Tehran, Iran

*** Corresponding author email address:** Parsaazizi111@gmail.com

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A B S T R A C T

This study examined the effectiveness of the Floortime method on sensory processing sensitivity, theory of mind, and social skills in children with high-functioning autism. A quasi-experimental pretest-posttest design with a control group was used. The statistical population consisted of children with high-functioning autism who attended autism rehabilitation centers in District 5 of Tehran in spring 2025. Thirty-six children were selected by convenience sampling and then allocated to experimental and control groups, with 18 participants in each group. Data were collected using the Sensory Profile School Companion, the Theory of Mind Test, and the Autism Social Skills Profile. The experimental group received twelve 75-minute Floortime sessions over six weeks, whereas the control group received no Floortime intervention during the study period. Data were analyzed using multivariate analysis of covariance and analysis of covariance in SPSS version 23. After controlling for pretest scores, the Floortime method significantly increased sensory registration, theory of mind, and social skills and significantly decreased sensory sensitivity and sensory avoiding. The intervention did not produce a statistically significant change in sensory seeking. The findings suggest that Floortime can support sensory regulation, social-cognitive understanding, and adaptive social behavior in children with high-functioning autism when implemented in a structured and developmentally responsive format.

Keywords: *Floortime; DIR model; sensory processing; theory of mind; social skills; high-functioning autism*

1. Introduction

Autism spectrum disorder is a neurodevelopmental condition characterized by persistent difficulties in social communication and social interaction, together with restricted, repetitive patterns of behavior, interests, or activities. These characteristics vary markedly across individuals, which is why autism is understood as a spectrum rather than a single uniform profile (1). Children who are commonly described as having high-functioning autism usually show average or above-average cognitive functioning, but they may still experience clinically important difficulties in sensory regulation, social cognition, and reciprocal social behavior.

Sensory processing is a central concern in autism because atypical responses to sensory input can interfere with learning, communication, play, and participation in everyday environments. Dunn's model describes sensory processing in terms of neurological thresholds and behavioral responses, including sensory registration, sensory seeking, sensory sensitivity, and sensory avoiding (2, 3). In children with autism, high sensory sensitivity and sensory avoiding may lead to distress, withdrawal, or behavioral dysregulation, whereas low registration may reduce the child's ability to notice and respond to relevant environmental or social cues (4). These sensory patterns are not isolated symptoms; they shape how children enter social situations and how much attentional capacity remains available for interpreting others' behavior.

Theory of mind refers to the ability to understand that other people have thoughts, beliefs, intentions, desires, and emotions that may differ from one's own. This ability is essential for predicting behavior, understanding social situations, and responding appropriately in interpersonal contexts. Theory-of-mind difficulties are well documented in autism and have been examined through tools such as the TOM Test and the Reading the Mind in the Eyes Test (5, 6). Such difficulties can limit a child's ability to understand another person's perspective, infer emotional states, or interpret implicit social meaning.

Social skills are also among the main areas of need for children with autism. These skills include initiating interaction, maintaining conversation, responding to nonverbal cues, sharing attention, taking turns, and forming stable peer relationships. The Autism Social Skills Profile was developed to assess social functioning and intervention outcomes in children and adolescents with autism spectrum disorder (7). Deficits in these skills may persist even when verbal or cognitive abilities are relatively preserved, which makes targeted intervention important for children with high-functioning autism.

Floortime is a relationship-based and developmentally oriented intervention derived from the Developmental, Individual-Difference, Relationship-Based model. Rather than focusing only on discrete behaviors, Floortime emphasizes emotional engagement, shared attention, child-led play, symbolic interaction, and the gradual expansion of reciprocal communication (8). Intervention studies and reviews suggest that DIR/Floortime and related developmental relationship-based approaches may improve parent-child interaction, social engagement, communication, and adaptive functioning, although the evidence base remains more limited than for some manualized behavioral interventions and should be interpreted with methodological caution (9-12).

The present study was conducted because few local studies have examined the simultaneous effects of Floortime on sensory processing, theory of mind, and social skills in children with high-functioning autism. Considering the close relationship between sensory regulation, social cognition, and social participation, the study aimed to determine whether a structured Floortime intervention can improve these outcomes in this group of children. The main research question was: Is the Floortime method effective in improving sensory processing sensitivity, theory of mind, and social skills in children with high-functioning autism?

2. Methods and Materials

2.1. Design and Participants

This applied study used a quantitative quasi-experimental design with pretest-posttest assessment and a control group. The statistical population included all children with high-functioning autism who attended autism rehabilitation centers in District 5 of Tehran in spring 2025. High-functioning autism was operationally defined according to the clinical diagnosis recorded in the participating rehabilitation centers and the child's functional ability to participate in the intervention and complete the study

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assessments. Based on the experimental design and Cohen's recommendations for behavioral intervention studies, 18 participants were assigned to each group, resulting in a total sample of 36 children (13).

Participants were selected by convenience sampling from eligible volunteers. After initial screening, they were randomly allocated to the experimental and control groups by drawing lots; this procedure was used to reduce allocation bias within the recruited sample, although convenience sampling limits external validity. Inclusion criteria were diagnosis of high-functioning autism, no reported history of comorbid psychiatric disorder or psychiatric hospitalization, no use of psychiatric medication, and consent from both the child and the parents. Exclusion criteria were withdrawal of consent by the child or parents, simultaneous participation in other psychotherapy or psychological intervention programs, incomplete pretest questionnaires, and absence from more than two intervention sessions.

2.2. *Instruments*

Sensory processing sensitivity. Sensory processing was measured using the Sensory Profile School Companion developed by Dunn (2006). The instrument assesses children's sensory processing patterns in school-related contexts and includes dimensions such as sensory registration, sensory seeking, sensory sensitivity, and sensory avoiding (3). Higher scores represent stronger expression of the relevant sensory pattern. In the present study, Cronbach's alpha values were .821 for sensory registration, .804 for sensory seeking, .787 for sensory sensitivity, and .810 for sensory avoiding.

Theory of mind. Theory of mind was measured using the TOM Test, originally developed to assess theory-of-mind ability in typically developing children and children with pervasive developmental disorders (6). The version used in this study includes 38 items and produces a total theory-of-mind score, with higher scores indicating more advanced theory-of-mind ability. Cronbach's alpha in the present sample was .845.

Social skills. Social skills were measured using the Autism Social Skills Profile developed by Bellini and Hopf (2007). The instrument includes 45 items rated on a four-point Likert scale and is designed to assess social functioning and intervention-related change in children and adolescents with autism spectrum disorder (7). Higher scores indicate more positive social behavior. Cronbach's alpha in the present sample was .871.

2.3. *Intervention*

The Floortime intervention was implemented according to a structured Floortime-based protocol adapted from Dehvari et al. (2022) and was delivered by the researcher in a group format. The program consisted of 12 sessions, each lasting 75 minutes, held twice weekly over six weeks (14). The control group did not receive the Floortime intervention during the study period.

The first session introduced the instructor, participants, group rules, program goals, and expectations. The second and third sessions focused on recognition of basic emotions, including happiness, sadness, anger, and fear, using visual and animated materials. The fourth session addressed desires and the emotional consequences of fulfilled or unfulfilled wishes. The fifth session focused on beliefs and encouraged children to infer what a story character wanted, thought, and felt. The sixth session identified each child's preferred stimuli and interaction patterns through observation. The seventh session used the child's cues to establish subtle emotional interactions. The eighth session emphasized symbolic play and problem-solving through dolls and fixed play materials. The ninth session focused on strengthening language by naming the child's actions, feelings, and daily experiences. The tenth session supported the development and expansion of ideas without direct adult control. The eleventh session targeted motor planning through construction, movement, puzzles, and problem-solving activities. The final session summarized previous sessions and obtained participant feedback.

2.4. *Statistical Analysis*

Data were analyzed using SPSS version 23. Descriptive statistics were calculated for all study variables. Multivariate analysis of covariance (MANCOVA) was used to examine group differences across the combined dependent variables after controlling for pretest scores. Analysis of covariance (ANCOVA) was then used to examine the effect of the intervention on each outcome. Normality, linearity, homogeneity of variances, homogeneity of covariance matrices, and homogeneity of regression slopes were

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checked before the main analyses. Because multiple univariate tests were conducted, the results were interpreted primarily against a Bonferroni-adjusted alpha level of .008, while exact p values and partial eta squared values are reported.

3. Findings and Results

Table 1 presents the descriptive statistics for the study variables by group and time point. The experimental group showed a marked increase in sensory registration, theory of mind, and social skills from pretest to posttest. Sensory sensitivity and sensory avoiding decreased in the experimental group. The control group showed only minor changes across the same period.

Table 1

Descriptive statistics for study variables by group and assessment time

Variable	Component	Time	n	Control M	Control SD	Experimental M	Experimental SD
Sensory processing	Sensory registration	Pretest	18	38.30	2.35	38.21	2.09
Sensory processing	Sensory registration	Posttest	18	38.73	2.19	51.16	3.16
Sensory processing	Sensory seeking	Pretest	18	27.04	2.17	26.90	2.17
Sensory processing	Sensory seeking	Posttest	18	27.34	1.74	27.08	2.37
Sensory processing	Sensory sensitivity	Pretest	18	38.42	2.26	37.95	2.02
Sensory processing	Sensory sensitivity	Posttest	18	39.20	1.74	32.04	1.53
Sensory processing	Sensory avoiding	Pretest	18	48.48	1.92	47.85	1.83
Sensory processing	Sensory avoiding	Posttest	18	46.75	1.94	40.13	1.86
Theory of mind	Total score	Pretest	18	15.39	2.00	16.44	2.01
Theory of mind	Total score	Posttest	18	15.00	1.37	22.11	2.65
Social skills	Total score	Pretest	18	71.78	7.67	71.83	6.05
Social skills	Total score	Posttest	18	71.72	5.52	85.61	7.74

The multivariate tests indicated a significant overall effect of group on the combined outcomes after controlling for pretest scores. Wilks' lambda was .033, $F(6, 23) = 112.165$, $p = .001$, partial eta squared = .967 (Table 2).

Table 2

Multivariate tests for the effect of Floortime on sensory processing, theory of mind, and social skills

Test	Value	F	Hypothesis df	Error df	p	Partial η^2
Pillai's trace	.967	112.165	6	23	.001	.967
Wilks' lambda	.033	112.165	6	23	.001	.967
Hotelling's trace	29.260	112.165	6	23	.001	.967
Roy's largest root	29.260	112.165	6	23	.001	.967

The ANCOVA results showed significant between-group differences in sensory registration, sensory sensitivity, sensory avoiding, theory of mind, and social skills after controlling for pretest scores. The effect on sensory seeking was not statistically significant (Table 3).

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Table 3

ANCOVA results for study variables

Source	Variable	SS	df	MS	F	p	Partial η²
Group	Sensory registration	1158.555	1	1158.555	171.961	.001	.507
Group	Sensory seeking	1.784	1	1.784	0.398	.533	.014
Group	Sensory sensitivity	371.332	1	371.332	140.351	.001	.634
Group	Sensory avoiding	326.104	1	326.104	88.683	.001	.760
Group	Theory of mind	344.814	1	344.814	83.080	.001	.748
Group	Social skills	1816.371	1	1816.371	44.212	.001	.612
Error	Sensory registration	119.280	28	4.260			
Error	Sensory seeking	125.466	28	4.481			
Error	Sensory sensitivity	74.081	28	2.646			
Error	Sensory avoiding	102.961	28	3.677			
Error	Theory of mind	116.211	28	4.150			
Error	Social skills	1150.323	28	41.083			
Corrected total	Sensory registration	1641.407	35				
Corrected total	Sensory seeking	209.618	35				
Corrected total	Sensory sensitivity	553.167	35				
Corrected total	Sensory avoiding	516.634	35				
Corrected total	Theory of mind	606.889	35				
Corrected total	Social skills	3272.000	35				

A separate multivariate analysis of the sensory-processing components also showed a significant group effect, Wilks' lambda = .047, F(4, 27) = 137.565, p = .001, partial eta squared = .953 (Table 4).

Table 4

Multivariate tests for sensory-processing components

Test	Value	F	Hypothesis df	Error df	p	Partial η²
Pillai's trace	.953	137.565	4	27	.001	.953
Wilks' lambda	.047	137.565	4	27	.001	.953
Hotelling's trace	20.380	137.565	4	27	.001	.953
Roy's largest root	20.380	137.565	4	27	.001	.953

The univariate sensory-processing analyses showed that Floortime significantly increased sensory registration and significantly decreased sensory sensitivity and sensory avoiding after controlling for pretest scores. Sensory seeking did not differ significantly between groups (Table 5).

Table 5

ANCOVA results for sensory-processing components

Source	Variable	SS	df	MS	F	p	Partial η²
Group	Sensory registration	1308.976	1	1308.976	113.453	.001	.532
Group	Sensory seeking	2.052	1	2.052	0.457	.504	.015
Group	Sensory sensitivity	417.653	1	417.653	165.587	.001	.641
Group	Sensory avoiding	354.761	1	354.761	102.083	.001	.771
Error	Sensory registration	125.280	30	4.176			
Error	Sensory seeking	134.751	30	4.492			
Error	Sensory sensitivity	75.668	30	2.522			
Error	Sensory avoiding	104.257	30	3.475			
Corrected total	Sensory registration	1641.407	35				
Corrected total	Sensory seeking	209.618	35				
Corrected total	Sensory sensitivity	553.167	35				
Corrected total	Sensory avoiding	516.634	35				

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Floortime had a significant effect on theory of mind, F(1, 33) = 97.084, p = .001, partial eta squared = .746 (Table 6).

Table 6

ANCOVA results for theory of mind

Source	Variable	SS	df	MS	F	p	Partial η^2
Group	Theory of mind	371.336	1	371.336	97.084	.001	.746
Error	Theory of mind	126.221	33	3.825			
Corrected total	Theory of mind	606.889	35				

Floortime also had a significant effect on social skills, F(1, 33) = 37.311, p = .001, partial eta squared = .531 (Table 7).

Table 7

ANCOVA results for social skills

Source	Variable	SS	df	MS	F	p	Partial η^2
Group	Social skills	1735.801	1	1735.801	37.311	.001	.531
Error	Social skills	1535.229	33	46.522			
Corrected total	Social skills	3272.000	35				

4. Discussion

The findings indicated that the Floortime method was associated with improved sensory registration, theory of mind, and social skills and with reduced sensory sensitivity and sensory avoiding in children with high-functioning autism. These results suggest that a relationship-based, child-led, and play-oriented intervention may influence several interconnected domains rather than only one behavioral outcome. The non-significant effect on sensory seeking should be noted, because it indicates that not all sensory-processing components changed in the same way.

The improvement in sensory registration and the reduction in sensory sensitivity and sensory avoiding can be interpreted through Dunn's sensory-processing model. Children with autism may either miss relevant stimuli or experience ordinary stimuli as overwhelming. Floortime provides repeated, emotionally safe, and motivationally meaningful interactions in which sensory input is embedded within play and shared affect. This structure may help children tolerate sensory input, notice relevant cues, and reduce defensive or avoidant responses. The finding is consistent with the broader view that sensory-based and relationship-based interventions may support adaptive behavior when they are individualized and embedded in meaningful participation (2, 4, 15).

The improvement in theory of mind may be explained by the intervention's emphasis on face-to-face interaction, shared attention, symbolic play, emotion labeling, and role-based scenarios. Theory of mind requires children to infer what others see, know, want, believe, and feel. Floortime gives children repeated opportunities to observe emotional cues, respond to another person's intention, and experience differences between their own perspective and the partner's perspective. This mechanism is consistent with theory-of-mind literature showing that social-cognitive understanding develops through interaction, perspective-taking, and interpretation of mental-state cues (5, 6).

The increase in social skills can be understood as a downstream effect of improved emotional engagement, sensory regulation, and social-cognitive processing. Floortime does not teach social behavior only through direct instruction. Instead, it creates interactive cycles in which the child initiates, responds, takes turns, and receives immediate relational feedback. These cycles may strengthen the child's motivation for interaction and make social behaviors more functional and internally meaningful. This interpretation is in line with evidence from developmental relationship-based

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interventions showing improvements in parent-child interaction, social engagement, communication, and adaptive behavior (9, 11, 12).

Several limitations should be considered. The sample size was small and selected by convenience sampling from rehabilitation centers in one district of Tehran, which limits generalizability. The diagnosis of high-functioning autism was based on available clinical records and functional eligibility for participation; standardized diagnostic instruments, IQ scores, and detailed demographic variables were not available in the source dataset and should be included in future studies. The study used a quasi-experimental pretest-posttest design; although group allocation was random after recruitment, a fully randomized clinical trial with concealed allocation would provide stronger evidence. The outcomes were measured immediately after the intervention, so maintenance of effects over time remains unknown. The control group did not receive an active comparison intervention, which means that nonspecific effects such as attention, expectation, and therapist contact cannot be fully excluded. Future studies should include larger samples, follow-up assessments, blinded outcome assessment, active control groups, standardized diagnostic confirmation, and direct observation of parent-child or therapist-child interaction.

5. Conclusion

The findings suggest that the Floortime method may help improve sensory registration, theory of mind, and social skills and reduce sensory sensitivity and sensory avoiding in children with high-functioning autism. Floortime can be considered a developmentally responsive and relationship-based intervention that may support sensory regulation, social-emotional understanding, and adaptive social participation. These conclusions should be interpreted in light of the small sample, convenience sampling, absence of follow-up, and lack of an active control condition.

Authors' Contributions

All authors contributed substantially to the study and to manuscript development, and all approved the final version.

Declaration

This manuscript was edited for English language, formatting, and reference consistency. The authors remain responsible for the scientific content, data, and interpretations.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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