

## Effectiveness of Theory of Mind Training in Social Cognition in Children with Attention Deficit Hyperactive Disorder

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### Abstract

Attention deficit hyperactivity disorder (ADHD) is a common neurobehavioral disorder with onset in childhood. The main goal of the present study was to examine the Effectiveness of theory of mind training in Social cognition in children with ADHD. In this semi-experimental research a pre-posttest and a control group was used. For this purpose, 80 children with ADHD were randomly selected and were divided into two groups-under training and control. The experimental group received theory of mind training and the control group did not receive the training. Training was performed in the experimental group for eight sessions (two sessions a week and each half an hour) on all subjects. Before the training and after that, Theory of Mind (ToM) assessment was used. The descriptive statistics and ANOVA were used to analyze the data. Analysis of variance showed that the social cognition scores of children in the theory of mind training group compared to the control group at posttest had increased ( $P < 0.001$ ). Therefore theory of mind training significantly increases social cognition. These results have important implication in field of mental health of children.

**Keywords:** Attention deficit hyperactive disorder; Intervention program; Social cognition; Theory of mind training

### Abbreviations:

ADHD: Attention Deficit Hyperactivity Disorder; ToM: Theory of Mind

### Introduction

Attention deficit hyperactivity disorder (ADHD), a common neurobehavioral disorder with onset in childhood [1], is characterized by developmentally inappropriate levels of hyperactivity, impulsivity in motor, emotional and social responses, a general lack of inhibition and pervasive inattention [2].

ADHD is associated with greater risks for low academic achievement [3] poor school performance, retention in grade, school suspension and expulsions, poor peer and family relation, anxiety and depression, aggression, conduct problems and delinquency, early substance experimentation and abuse, driving accidents and speeding violations, as well as difficulties in adult social relationship, marriage and employment. Often, these children have impairment in emotional self-control, self-regulation of drive and motivation. Numerous studies have reported cognitive disabilities in memory, executive functions, spatial abilities and language skills [4-6]. As well as, It is associated with impaired functioning not only in cognitive and academic domains, but in social ones, too [7]. Children with ADHD display inadequate social behavior and have impaired social cognition [8].

### Social Cognition

Social cognition can be briefly defined as the ability to understand other people's minds and, more specifically, to perceive emotion,

empathies, attribute false belief and understand intended meaning, among others. It is essential for successful social interactions. Although deficits in the social cognition domain are clinically observed in ADHD, little research has been carried out in this area. Some authors have reported social cognition difficulties in children with ADHD, specifically in emotion perception and/or processing [9], empathy [10,11], theory of mind [12] and pragmatics [13-15]. Social cognition deficits are not strictly limited to people with ADHD and there are a variety of circumstances and disorders that can hinder ToM development [16]. However, some ADHD researchers have pointed to impairment in specific social cognitive domains [17] as a basis for social dysfunction in ADHD. On the other hand, social deficits more generally (i.e., not specific to ADHD). Never the less, children with ADHD tend to encode social information less accurately and, in turn, have difficulty integrating social cues and formulating appropriate responses [18,19]. Also, some researchers have implicated biased or distorted social attribution as a causal factor underlying the social dysfunction in ADHD. For example, [20] reported that children with ADHD not only detected fewer social cues but also attributed more negative and less positive intent to peers and generated fewer positive responses compared to normal children.

### Theory of Mind

Social cognition encompasses ToM, but also the ability to perceive emotions from faces, body and postures, and empathy and humour processing. ToM functions emerge with differing levels of complexity during a child's development, starting with the ability to understand that another person has a specific belief about a situation (first-ToM) and, finally, the development of advanced ToM competences (high-order ToM) that involve interpreting complex social situation, based on subtle information. Many experimental paradigms have been used to study ToM, including mental state terms, stories, single-frame

cartoons, comic strip cartoons and interactive games [21]. Children with ADHD fail in some tests of ToM and display impairments involving emotion, face and prosody perception, and reduced empathy. It is likely that it is their impulsivity and lack of ability to focus attention, and the behavioral problems that these give rise to, that hinder ToM development in children with ADHD [22].

The aim of this study was to test whether a ToM training intervention can improve social in children with ADHD.

## Method

### Participants

The sample of this study consisted of 80 children (40 experiment group and 40 control group) aged between 8 and 12 years, diagnosed with ADHD predominantly hyperactive/impulsive presentation and who were not taking any psychopharmacological treatment at the time of the study, and had not taken medication previously. The participants are students from various schools in the Tehran city, Iran. All of them were unaware of the purpose of the intervention and agreed to participate voluntarily. Subjects received no compensation for participating in the study. Inclusion criteria included being aged between 8 and 12, attending any schooling the Tehran city (Iran) and having been diagnosed with ADHD. Exclusion criteria included presenting some kind of mental disorder, intellectual disability or visual/hearing impairment. Students who were taking, or had been taking, psychopharmacological treatment for Attention Deficit and Hyperactivity Disorder and those students who had previously attended psychological therapy were also excluded.

### Intervention

The intervention's treatment manual was followed and sessions were reviewed for treatment adherence. The treatment manual is available from the first author by request. The intervention focused on skill-building via affective education, stress management, and understanding expressions of emotions. A group therapy approach was used to teach the children to recognize emotions in themselves and others. The therapy facilitated socio-emotion understanding by teaching social and cognitive tools to "fix" intense emotions. Sessions were structured in such a way as to have a Welcome Time, Singing, Story Time, Activity/Lesson Time, Snack, and Goodbyes, all revolving around a particular topic. The topics for the eight sessions were:

Session 1: Understanding positive emotions of happiness in face by picture.

Session 2: The perception of emotional facial expressions.

Session 3: Socio-Emotional Toolbox 1: Introduction and Teaching states of face.

Session 4: Emotional Toolbox 2: Teaching social tools.

Session 5: Emotional Toolbox 3: Teaching thinking tools.

Session 6: Emotional Toolbox 4: Teaching special interest tools.

Session 7: Emotional Toolbox 5: Identifying appropriate and inappropriate tools.

Session 8: Review Session: Create a production (similar to a commercial) to highlight tool store member.

## Procedure

Before initiating the study, parents were interviewed and informed about the program. They were then asked if they were willing to participate in the study and given the informed consent. The participants initiated the first phase of the study with individual sessions. The tests were conducted in room adapted for the administration of this type of assessment. At this stage, the ToM assessments were administered individually to assess social cognition. Once finished this part of the study, the theory of mind intervention program was administered to the group. Finally, the assessment tests of social cognition, ToM assessments were administrated again.

## Material

### Theory of mind (ToM) assessment

We used two second-order false belief tasks to assess ToM: the ice cream story [22] and the birthday story [3]. The ice cream story was presented in comic strip form. The children were told a story involving two friends, John and Mary. John and Mary are independently informed that the ice-cream van has been unexpectedly transferred to a new location, moving from the park to the church. Hence, both John and Mary know where the van was, but there is a mistake in John's second-order belief about Mary's belief: John thinks that Mary thinks that the van is still in the park. The children were asked successively: "Where will John look for Mary?" (Prediction question), "Why will John look for Mary in the park?" (Explanation question), "Where is Mary?" (Control question), and "Where is the ice-cream van?" (Reality question). The control and/or reality questions had to be answered correctly for points to be awarded for the other two questions (1 point for each correct answer, i.e., max. 2 points). For the birthday story, children were asked to listen to a story involving Peter, his Mum and his Grandma, and were told that they would be asked questions throughout the story. The story can be summarised as follows: it is Peter's birthday and his Mum wants to surprise him with a puppy. She tells Peter that she has bought him a great toy for his birthday (Question 1 asked here), but Peter then finds the birthday puppy in the basement (Question 2 asked here). His Mum does not see him go down to the basement. When Peter's Grandma phones his Mum to find out what time the birthday party is, she asks her, "Does Peter know what you've really got him for his birthday?" (Question 3 asked here) After Mum has answered, Grandma says, "What does Peter think you've got him for his birthday?" (Questions 4 and 5 asked here). Children were asked the following questions: "What has Mum bought for Peter's birthday?" (Question 1: control), "Does Peter know that his Mum's got him a puppy for his birthday?" (Question 2: first-order ignorance), "What does Mum say to Grandma?" (Question 3: second-order ignorance), "What does Mum say to Grandma?" (Question 4: second-order false belief), "Why does Mum say that?" (Question 5: justification). The control question had to be answered correctly for points to be awarded for the other four questions (1 point for each correct answer, i.e., max. 4 points).

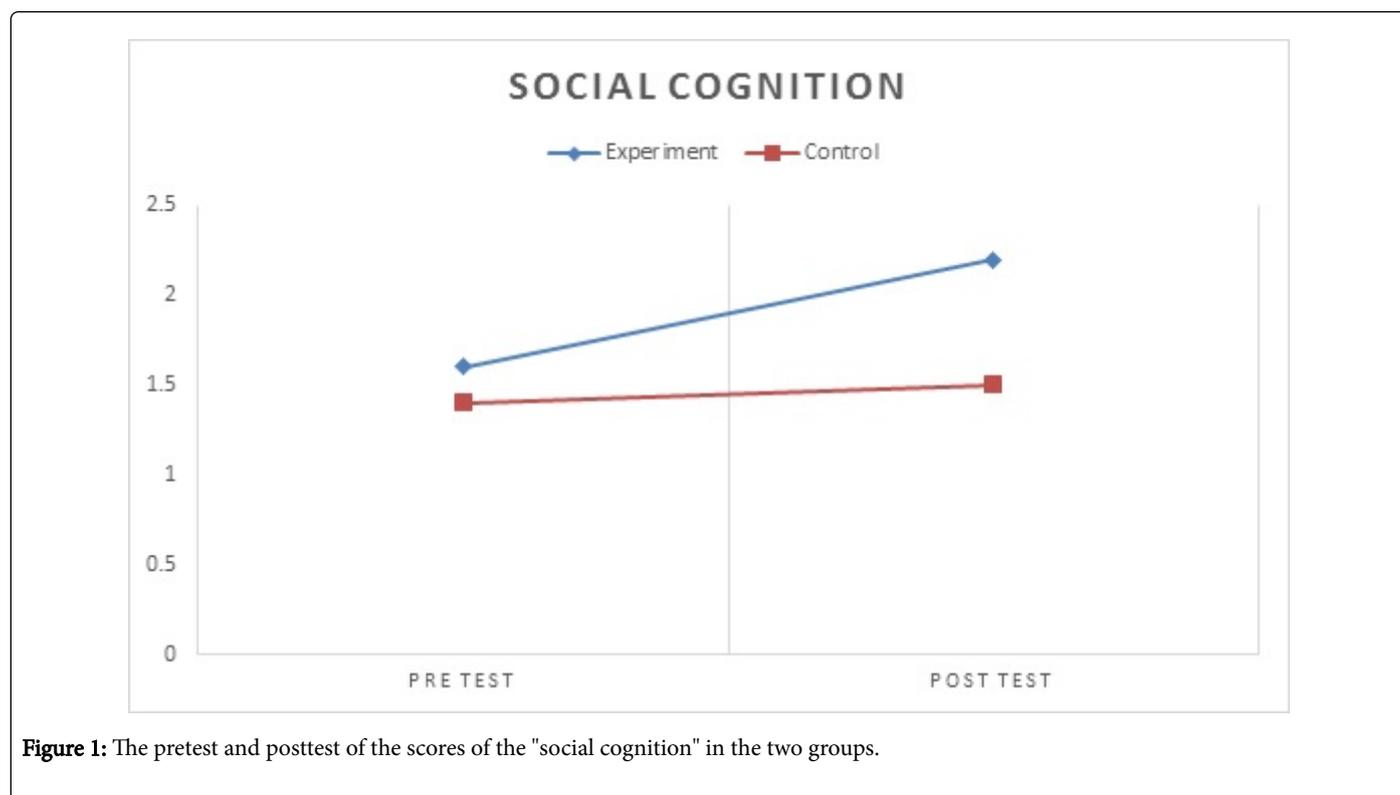
## Results

Data were analyzed with SPSS 18.0. The statistical techniques were descriptive (arithmetic mean and standard deviation) and ANOVA (Analysis of variance). No statistically significant differences were found with regards to age. The results showed an improvement in both tests after theory of mind training intervention (Table 1). After the

intervention, the children took less wrong to estimate the ToM (Figure 1).

Groups	N	Stages	Test	Mean	Standard Deviation
Experiment	40	pretest	Theory of Mind (ToM)	1/6	0/89
		posttest		2/7	0/52
Control	40	pretest	Theory of Mind (ToM)	1/5	0/87
		posttest		1/4	0/78

**Table 1:** The pretest and posttest statistical description of the scores of the "social cognition" in the two groups.



**Figure 1:** The pretest and posttest of the scores of the "social cognition" in the two groups.

According to Table 1 and its mean and standard deviation, the difference among assessments of the social cognition of the experiment and control groups is not significant. On the contrary, the mean of the scores of the social cognition of the experiment group in pretest (1/6) and posttest (2/7) shows significant difference. But in the control group there is a slight and intangible. Therefore, in order to have a more precise analysis, and to see whether the difference is statistically

significant or not and to control the mean impact, we used the analysis of variance and its results are valuable in Table 2. Two groups were compared for the cognition social measured at Table 2 through a one-way ANOVA evidencing a significant difference across groups ( $F(1.78)=3/12; p>0/001$ ). Scheffé post-hoc tests indicated that the experiment group had upper cognition social scores ( $M=0.2/7; SD=0/52$ ) than the control group.

The source of the changes	SS	DF	MS	F
Groups	22/49	1	22/49	3.12*
Error of within group	18/52	77	0/24	
Total	6998	80		

\*P<0/05; \*\*P<0/01

**Table 2:** Results of ANOVA for interaction effect in social cognition

## Discussion

It is increasingly recognized that ADHD is a lifelong disorder and the focus of school-based interventions needs to be long-term: individualized education and behavioral plans that require ongoing evaluation, modification, and implementation, over months and years. Currently, medication is the predominant treatment for children with ADHD [18] in spite of the fact that the NICE [22] recommend that the first treatment option should be psychological interventions.

The main objective of this work was to determine if theory of mind training intervention program could improve social cognition in children with Attention Deficit Hyper-activity Disorder. Results indicate that such a program does lead to improved performance in the social cognition task that evaluate social cognition. Uekermann [17] has theorized that Children with ADHD often experience social difficulties. Social skills training (SST) has achieved some positive results for assisting children with ADHD in their social adjustment, but they are usually limited to settings with active behavioral program in place to promote the skills. The grouping of children in SST is an important consideration, since aggressive behavior may increase in some children if nonaggressive and aggressive children participate together in groups [19].

Buhler et al., [8] examined the computer-based emotion recognition task on Social Attribution Task in children with ADHD and Asperger. They demonstrated ToM deficits develop in clinical populations with age. Perhaps children with ASD lack a prerequisite or foundational ToM, while children with ADHD develop deficits in ToM over time. One of the original features of our work is the incorporation of more diverse considerations. We examined the importance of making sure that the child understands the process. In the program, we clearly explained the nature of ADHD and its consequences. We worked on the concepts of emotional states to later link them to the ideas of emotion recognition. Another aim was to improve the child's control over emotions and social skills as a lack of inhibition can provoke difficulties in relationships with peers and adults. In short, we encouraged the children to attention their own abilities and we acted as a guide that aimed to help them overcome their problems by means of an optimistic interpretation of any given situation.

## Conclusion

The results of our study revealed that theory of mind training (mental states; understanding that seeing leads to knowing; refuses to be corralled) is a useful program for social cognition in children with ADHD. Our experimental group who received training had higher levels in social cognition. If people learn how to reform their access to both one's own and others' mental states, engage in joint attention and pretense, the understanding of play pragmatics, empathy, intentionality, and the capacity to distinguish appearance from reality and the mental from the physical world have an effective relationship with others, manage environmental stresses and reform their life styles, they would experience high levels of self-esteem, educational progress, and social support. People, who learned to use adaptive face cues strategies, would report high level of relationship with other. There continues to be a need for a better understanding of how to match specific instructional materials and social cognition techniques to the individual characteristics of the child, and how to enhance knowledge of social cognition and improve maintenance and generalization of intervention effects.

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