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The Mind Theory in Children with Autism Spectrum Disorder (ASD): A Narrative Review

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Abstract

Background and aim: Due to the numerous problems of patients with Autism Spectrum Disorder (ASD) due to lack of proper understanding of the minds of others as well as their minds, the purpose of this study is to review the theory of mind and related factors and its influence (especially the role Education) in patients with ASD.

Materials and methods: For this purpose, all studies related to the subject, during 1991-2021, were systematically searched in internationally available databases, including Web of Science, Science Direct, Scopus, PubMed, and Google Scholar. Finally, 21 completely relevant studies were selected to extract the results.

Results: Children with autism, compared to normal children, have significant defects in developing different levels of theory of mind. According to the results of most studies, children with ASD received the lowest score in the whole test and the sub-levels of mind theory tests, while the highest score was assigned to normal (healthy) children. In addition, mind theory-based education can increase different levels of mind theory in children with ASD.

Conclusion: It can be concluded that ASD causes severe damage to the functions of social cognition, especially the theory of mind in patients, based on study results. However, in early childhood, these patients' adverse effects on social cognition and mind theory functions can be reduced by providing efficient and effective education.

Keywords: Training • Patients • Researchers

Introduction

One of the most difficult challenges that children encounter is gaining knowledge of the world they live in. Following the concept of cognition, it became clear that people's thoughts contribute to their cognition. However, it should not be forgotten that cognition begins with a person's relationship with the outside world and is, in fact, a social product [1]. Therefore, understanding self and others are essential for effective social interactions and has always been the focus of researchers [2].

Social perception is defined as the process that regulates behavior in response to peers. In addition, social perception, in particular, contributes to higher perceptual processes that promote the very diverse and flexible social behaviors seen in mammals [2]. Much research on social cognition has been inspired by the writings and ideas of Jean Piaget. Since researchers in social cognition are influenced by the theory of cognitive evolution, it is not surprising that many of them emphasize that a child's inference and reasoning about people and social relationships go through stages or levels and is qualitatively distinct; however, it has new features and organized construction [3].

Historically, there have been three main research processes in developing children's mind knowledge: The first is directly or indirectly related to Jean Piaget's research. Piaget believed that children initially knew that there were conceptual, perceptual, and emotional perspectives. Still, they naturally cannot understand that they have such views or that others act according to them. In addition, children may inadvertently report their views when asked to comment on the views of others. The second process, which began in the early 1970s, consists of research on the development of metacognition in children. Metacognition means knowledge about the nature of individuals as holders of knowledge and about the nature of various cognitive tasks and possible strategies that can be used to perform various tasks. Also, metacognition includes an individual's executive skills to regulate and monitor their cognitive activities. Finally, the third process, which is the mind theory, began in 1980 and now dominates this whole field [3,4].

Mind theory is the ability to understand that others have mental states such as thoughts, inclinations, and believes different from mental states and reality. Thus, the theory of mind is defined as the continuous representation of one's and others' mental states. It refers to the cognitive capacity to represent its own and others' mental states [5]. Premack & Woodruff used the term "theory of mind" for the first time [6,7]. They somehow believed in the primitive theory of mind for chimpanzees. According to them, chimpanzees can understand the mental states of their species. Animal research also has a special place today because it helps recognize the non-verbal content of behaviors related to the theory of mind and understanding how human social cognition evolves [8]. People with mental disabilities have difficulty explaining the intentions of others. Also, these people do not understand how their behavior affects others, and they face problems in social interaction [9].

Autism Spectrum Disorder (ASD) is one of the most debilitating developmental disorders. A unique feature of this disorder is a profound defect in social understanding. First, Baron-Cohen et al. pointed to the relationship between this disorder and theory of mind and asked, "Does a child with ASD have a theory of mind?" This question led to a lot of research, and these studies have significantly increased our knowledge of

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this strange disorder [10,11].

According to this theory, children with ASD and Asperger syndrome have a delay in developing the theory of mind, and this causes them to develop varying degrees of mental blindness. As a result, they find the behavior of others confusing, unpredictable, and even frightening. Evidence to support this claim is the problems these people show in mind reading and occurring at different stages of development, with different intensities [12]. Levin Allen similarly found that Asperger's eight-year-old children had a weaker understanding of the feelings and perceptions of others when compared to children of typical development with autism [13].

The theory of mind has three levels, which include the first level (ability to recognize emotions and pretend), the second level (understanding the primary misconception), and the third level (understanding the secondary misconception) [14].

The study of the theory of mind and its various dimensions in children with mental disorders is critical, and in addition, there is no comprehensive review of the above topic. Therefore, the purpose of this study is to survey different levels of mind theory, determine the factors affecting the evolution of levels of this theory, and determine the education effect on improving mind theory in children with ASD.

Materials and Methods

To review and extract the required results among the articles and published reports related to the subject under study. Systematic searches of internationally available databases including Web of Science, Science Direct, Scopus, PubMed, and Google Scholar were conducted from 1991 to 2021. Systematic review was performed using the terms including "Mesh terms", "Mind theory", "Education", "ASD", "Autistic", "Patients", "Children", "Adults" and "Autistic Spectrum Disorder". For other databases, the same Mesh terms were used similarly. The references were carefully checked to ensure that no articles were missed from the study (Reference Checking). The citations from the research were also reviewed (Citation Tracing) to ensure that the search was complete. Based on Figure 1, literature was searched and received articles based on the PRISMA guideline [15]. In addition, unofficial reports, articles in a letter to editor format, and unpublished articles and content posted on Internet sites were removed from the list of downloaded files. Finally, the results of 21 published articles were reviewed for the present review.

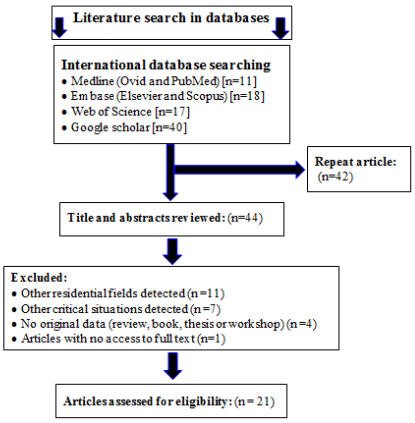

Figure 1. Flow diagram of study identification according to PRISMA.

Results and Discussion

Assessing the levels of mind theory in children with autism compared to other children

Before presenting any solution to reduce the problems associated with mental theory deficits in patients with ASD, an initial assessment of theories of mind theory among children with autism is necessary. A summary of the results of some related studies is presented in Table 1.

Table 1. Summary of results from various studies on mind theory in patients with ASD.

References	Important results
Mansuri et al.	• Children with autism have significant deficits in developing different levels of mind theory compared to normal children. • The age variable does not a ffect the evolution of the mind theory. • The variables of IQ and gender have a significant effect on the evolution of mind theory. • Mental maintenance plays a role in the occurrence of defects in the mind theory.
Moosavi et al.	• Children with ASD scored the lowest on the whole test and the subtest levels of mind theory, while the highest score was assigned to normal (healthy) children. • There was no significant difference in the theory of mind scores between the two groups of girls and boys with ASD (P>0.05).
Sari et al.	• Normal children scored higher than the mentally retarded group in terms of the level of mind theory. However, the mentally retarded group scored higher in terms of the level of mind theory than the group of children with ASD.
Happé and Vital	• Children with ASD are less likely than other groups to understand the thoughts and feelings of fictional characters.
Bühler et al.	• Among young people, in terms of inhibitory control, the ASD group performed better than the Attention Deficit Hyperactivity Disorder (ADHD) group. In terms of mind theory, the ADHD group performed better than ASD. While among children, there was no difference in terms of the above variables among the two groups of ASD and ADHD.
Allen	• People with autism have had the most difficulty in identifying surprise, which requires knowing the different opinions of others. • People with autism are oblivious to anger, happiness, and sadness.
Hobson	• Autistic children process information about emotional facial expressions differently than normal children. • Autistic children do not respond well to the emotions of others.
Jenkins and Astington	• None of the mind theory abilities is specific to a particular gender, and in general, the mind theory is not significantly different between men and women.
Baron-Cohen et al.	• Different levels of mind theory have higher performance in autistic adult women than in autistic men.
Allen et al.	• Mind theory training can improve all three levels of mind theory in children with autism. • The performance of children's mind theory with autism disorder is improved by training at belief, perception, and desire. • Training mind theory improves emotion recognition and pretense (the first level of mind theory) in children with ASD. • Training mind theory improves understanding of early misconceptions (second level of mind theory) in children with ASD.
Fisher et al.	• Mind theory training can improve all three levels of mind theory in children with autism.

Gevers et al.	• Mind theory training can improve all three levels of mind theory in children with autism. • Mind theory training does not improve emotion recognition and pretense (the first level of mind theory) in children with ASD. • Mind theory training improves understanding of early misconceptions (second level of mind theory) in children with ASD. • Mind theory training improves the perception of secondary misconceptions (third level of mind theory) in children with ASD.
Begum et al.	• People with disabilities had their levels of mind theory increased after 15 sessions of using images and storytelling. • Mind theory training improves emotion recognition and pretense (the first level of mind theory) in children with ASD. • Mind theory training improves understanding of early misconceptions (second level of mind theory) in children with ASD. • Mind theory training improves the perception of secondary misconceptions (third level of mind theory) in children with ASD.
Seyfi et al.	• Teaching false beliefs to students with 8 to 11 years of mental retardation showed that this training has led to better performance in the theory of mind task. • Mind theory training improves emotion recognition and pretense (the first level of mind theory) in children with ASD. • Mind theory training improves understanding of early misconceptions (second level of mind theory) in children with ASD. • Mind theory training improves the perception of secondary misconceptions (third level of mind theory) in children with ASD.
AdibSareshki et al.	• Teaching false beliefs to students with 8 to 11 years of mental retardation showed that this training has led to better performance in the theory of mind task. • Mind theory training improves emotion recognition and pretense (the first level of mind theory) in children with ASD. • Mind theory training improves understanding of early misconceptions (second level of mind theory) in children with ASD. • Mind theory training improves the perception of secondary misconceptions (third level of mind theory) in children with ASD.
Khodabakhshi et al.	• Mind theory training is an important factor in developing mind-reading skills and executive functions in children with ASD.
Fisher and Happe	• Mind theory training is an important factor in developing mind-reading skills and executive functions in children with ASD.
Feng et al.	• Mind theory training is an important factor in developing mind-reading skills and executive functions in children with ASD.
Downs and Smith (2004)	• Mind theory training is an important factor in developing mind-reading skills and executive functions in children with ASD.
Appleton and Reddy	• Mind theory training is an important factor in developing mind-reading skills and executive functions in children with ASD.

A study by Moosavi et al. compared the levels of mind theory among children with autism, mental retardation, attention deficit hyperactivity disorder, and normal children. This study showed that children with ASD received the lowest score in the whole test and the levels of subtests of the theory of mind, while normal (healthy) children received the highest score. The scores obtained by the other studied groups (including children with intellectual disabilities and hyperactive children) were ranked between the scores of autistic children and normal children. In addition, based on the results of this study, there was a significant difference between the four groups in terms of mind theory scores ($P<0.05$) [16].

Based on the results of the study of Moosavi et al. it can be concluded that children with ASD, mentally retarded, as well as children with attention deficit-hyperactivity disorder, have many problems in the ability of theory of mind, which can negatively influence on their social performance [16]. The study results by Sari et al. showed that normal children scored higher in terms of the level of theory of mind than the mentally retarded group. In addition, the mentally retarded group scored higher on the level of theory of mind than the group of children with ASD [17].

In another similar study, Happé and Vital assessed four groups of subjects, including non-disabled autistic children, normal children, normal adults, and mentally disabled children, to assess children with ASD of fictional thoughts and feelings. This study showed that children with ASD, compared to other groups, are weaker in understanding the thoughts and feelings of fictional characters [18].

Bühler et al. conducted a study to differentiate between Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD), using inhibitory control and mind theory. This study showed that in terms of inhibitory control among young people, the ASD group performed better than the ADHD group, while in terms of mind theory, the ADHD group performed better than the ASD group. However, among children, the above differences were not observed. Based on the results of this study, it was shown that the lack of theory of mind is different in different developmental periods [19].

According to Allen study on emotion recognition, autistic people have the most trouble identifying surprise, which requires familiarity with the opinions of others. In addition, the results of this study showed that people with autism are inattentive to nervousness, happiness, and sadness [13]. The results of Hobson study showed that autistic children process information about emotional facial expressions differently than normal children and do not respond appropriately to the emotions of others [20].

Factors affecting the evolution of levels of mind theory in children with ASD

Investigating the effect of different variables on the levels of development of mind theory ability in children with ASD is another goal of the present study, which summarizes the results of related studies in Table 1. Mansuri et al. was a case-control study performed on 19 children with ASD and 19 normal children. In this study, in addition to age-based matching, various tests, including the Wechsler Intelligence Scale for Children, Stimman theory of mind, and mental maintenance tasks, were performed for both groups. The tests showed that children with autism, compared to normal children, have a significant defect in developing different levels of the theory of mind, but age has no effect. In contrast, both IQ and gender have a significant effect on the evolution of mind theory. In addition, according to the study results, mental retention alone plays a role in the occurrence of defects in the theory of mind [21].

The study of Moosavi et al. showed that the scores of mind theory were not significantly different between the two groups of girls and boys with ASD, mental retardation, attention deficit hyperactivity disorder, and normal children ($P>0.05$). Although girls' performance in the first and third levels of mind theory and boys' performance in the second level of theory of mind was slightly higher, these differences were not statistically significant [16]. Based on the study of Jenkins and Astington, it was found that none of the abilities of the theory of mind is specific to a particular gender, and in general, the theory of mind is not significantly different between the two sexes [22]. However, Baron-Cohen et al. study results showed that different levels of theory of mind in autistic adult women have a higher performance than the group of autistic men [23].

Finally, it can be said that today there are not as many gender differences as having been reported in previous decades. Researchers have shown that gender differences have decreased in recent years. The

reason is mainly related to social change, socialization stages, cultural contexts, and the emergence of equal opportunities for both sexes [16].

The effect of training on improving the levels of mind theory in children with ASD

In addition, children with ASD cannot understand the minds of others and have fundamental problems understanding that others may have different minds. Therefore, on the one hand, it is necessary to provide mind theory training programs to improve and enhance the levels of mind theory of children with ASD. However, on the other hand, the effectiveness of the training program is another issue that should be considered. Therefore, various studies have been conducted on the importance of providing training programs in improving the mind theory and the effectiveness of these programs. The summary of the results of these studies is presented in Table 1.

Yaghooti et al. conducted a study on the effectiveness of mind theory training based on the Hall and Tager-Flusberg model and its role in improving mind theory levels in children with ASD. In this study, 12 children with ASD with an age range of 7 to 10 years were selected using the available sampling method and divided into two groups of 6 (experimental and control). Both groups were evaluated in two pre-and post-test stages of the theory of mind Steirnman, Iranian standard form. The mind theory intervention program was taught to the experimental group for 25 sessions, and the control group did not receive this training. The results of this study showed that the intervention program was able to increase the mean of subscales of mind theory in the experimental group ($P<0.001$), while the control group did not change significantly in all post-test subscales [14].

In addition, the results of some other studies, such as Allen et al. Fisher et al. and Gevers et al. showed that training mind theory could improve all three levels of mind theory in children with ASD [24-26]. For example, in part of his results, Allen et al. showed that children's mind theory with ASD is improved by training at the level of belief, perception, and desire [24].

Fisher et al. also showed that training mind theory significantly increases scores at different levels of mind theory in children with ASD. Begum et al. Improved levels of mind theory in people with disabilities using images and storytelling in 15 sessions [27]. Students with 8 to 11 years of mental retardation were offered false beliefs by Seyfi et al. and AdibSareshki et al. [28,29], and this practice led to better performance in the task of mind theory. The study by Yaghooti et al. showed that mindfulness training improves emotion recognition and pretense (the first level of mind theory) in children with ASD [14]. This finding in other studies, including Allen et al., Fisher et al., Begum et al., Seyfi et al. and AdibSareshki et al. [24,25,27-29] have also been confirmed. However, in the study of Gevers et al., this issue has not been confirmed [26].

Children with ASD have delays in the development of mind theory, but they are better able to remember their own beliefs than to predict the views of others, as can be explained by this discovery. In their view, high-functioning ASD children use language for mind reading because they cannot use natural social and conversational tips to understand the minds of others. In addition, a group of them have more grammar skills and will perform better in the tasks of misconception [24].

Based on the results of various studies [14,24-30], mind theory training improves the understanding of the initial misconception (second level of mind theory) in children with ASD. It's possible to explain this result by stating that contemporary psychologists extend the scope of cognition to other social and psychological characteristics of human beings without intending to ignore precise intelligence processes. At a glance, cognition is a flow that flows with internal and external processes and resources. Several constructs have been considered in social cognition, including the role of a construct such as the theory of mind. Theory of mind acts as an umbrella that dominates children's perceptions of the mental states of others [29].

The results of some other studies [14,24-30] also show that mind theory training improves the perception of secondary misconceptions in children with ASD. For clarification, it might be stated that when a child is aware of their emotional states, they can use the ability to pretend and attribute those emotions to inanimate objects or other individuals. However, it's also important to recognize that reality in other people's imaginations can differ from reality in their own [31].

In another study conducted by Khodabakhshi et al. it was found that education based on mind theory is an essential factor in the development of mind-reading skills and executive functions in children with ASD [32]. This finding has been found in other similar studies, including Fisher and Happe, Feng et al., Downs and Smith, and Appleton and Reddy have been confirmed [33-35].

Conclusion

Based on the present study results, it can be concluded that ASD causes severe damage in social cognition functions, especially mind theory in patients. However, its adverse effects on social cognition and mind theory functions in these patients can be reduced to some extent by providing efficient and effective education. Also, based on the results of various studies, it can be concluded that training based on mind theory can improve mind-reading skills and executive functions in children with ASD. Therefore, it is essential that parents and all educators who work with these children provide a rich environment and then provide the necessary training so as much as possible, reducing damage to patients with ASD influencing the functioning of mind theory. In addition, due to early states related to the ability of mind theory in people with autism, some aspects of mind theory can be provided in early childhood and the early stages of diagnosis through compensatory training and rehabilitation strategies.

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