

# Impact of Modified Sensory Board Game on Sensory Processing Among Children with Autism Spectrum Disorder

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## ABSTRACT

Autism spectrum disorder (ASD) is a condition defined by clinically significant impairments in social communication, social interaction, and restricted or repetitive interests and behaviours. Although social deficits are the core feature of ASD, sensory processing impairments are common in this population as well. The purpose of the study is to determine the impact of modified sensory board games on sensory processing among children with autism spectrum disorder (ASD). The study was done using a quasi-experimental design and the convenient sampling technique was adapted to select the ASD children with sensory processing deficits in the age group of 4-8 years. Totally thirty children were selected and divided into two groups. 15 children in the control group and 15 children in the experimental group. Totally 36 sessions were conducted, three sessions per week for about 45 minutes. The statistical analysis showed significant improvement in both groups when compared to the post scores of the both groups, there was highly statistically significant showed in the experimental group. Hence this study concluded that modified board game shown a good improvement in dealing with sensory processing among children with autism spectrum disorder.

**Key words:** Autism spectrum disorder, sensory processing, modified sensory board game

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## INTRODUCTION

Autism spectrum disorder (ASD) is a condition defined by clinically significant impairments in social communication, social interaction, and restricted or repetitive interests and behaviours. Although social deficits are the core feature of ASD, sensory processing impairments are common in this population as well. In 2018 the CDC (centre for disease control and prevention) determine that approximately 1 in 59 children is diagnosed with ASD. From 2012 to 2014 it has been increased to 15%.

Ayres (1979) described the brain as a sensory processing machine whereby the brain senses stimuli and processes and integrates the stimuli into the central nervous system, enabling the body to respond adaptively as the sensory information is used to plan and organise behaviour.

The Sensory Integration intervention is based on three concepts: neural plasticity makes brain change possible, active participation is required for neural changes and an enriched environment is needed to guide the neural changes. The treatment sessions are planned to provide a controlled sensory experience to obtain adapted behaviour or response, as well as to help the nervous system efficiently modulate, organise and integrate the information provided

## MODIFIED SENSORY LUDO BOARD GAME

Ludo is a strategy board game for two to four players in which the players race their tokens from start to finish according to the rolls of a single die. Here we use an adapted version of the ludo board according to the needs of the children. we incorporated different textures which give a good sensory experience to the children to help the

nervous system to modulate, organise, and integrate the different information. The game is played, basically, in the same way as ordinary Ludo.

**AIM:**

To determine the impact of modified sensory board games on sensory processing among children with ASD

**OBJECTIVE:**

1. To find out the children with autism spectrum disorder
2. To find out the impact of conventional Occupational Therapy programs on the control group
3. To find out the impact of the modified sensory board game in an experimental group
4. To compare the effect of the modified sensory board game with conventional Occupational Therapy program

**HYPOTHESIS:**

There is significant improvement in sensory processing among children with autism spectrum disorder.

**RESEARCH DESIGN**

A Quasi-experimental type with quantitative method of study was used to determine the impact of modified sensory board game on sensory processing among children with autism spectrum disorder.

**Sample Technique**

Convenience sampling technique was adopted.

**Sample Size**

Total of 30 children

Control group- 15 children

Experimental group- 15 children

**Sample Setting**

Samples were selected according to the inclusion and exclusion criteria from the Aadhura special school, Kancheepuram.

**Variables**

- a) **Independent variable:** Modified sensory board game
- b) **Dependent variable:** Sensory processing

**Selection Criteria**

**Inclusion Criteria:**

- Children diagnosed with Mild Autism Spectrum Disorder (**ISAA score-70 to 106**)
- Children aged from 4 to 8 years
- Both males and females are included
- Children with difficulty in sensory processing among autism
- Children with tactile, visual, auditory, behaviour, and movement problems were included

**Exclusion Criteria:**

- Children with Moderate ASD and Severe ASD
- Children diagnosed with attention deficit hyperactive disorder, learning disability, and down syndrome
- Children with visual impairment and hearing impairment

**Instrument Used**

1. **Indian scale for assessment of Autism (ISAA)**
2. **Short sensory profile -2**
3. **Modified sensory board**

**Duration:**

- The duration of the study was 3 months
- 45 minutes per session, 3 days a week
- 36 sessions

### Procedure

A total of 30 children aged between 4 to 8 years, who were diagnosed with Mild Autism Spectrum Disorder participated in this study to enhance their sensory processing skills. The pre-test assessment was assessed using the short sensory profile - 2. After the completion of the pre-test assessment which includes the first two sessions of the study, the participants were divided into two groups with 15 participants in each experimental and control group, which includes 10 male and 5 female children in both the groups. The experimental group underwent OT intervention with the modified sensory board game whereas the control group attended OT therapy sessions. After the completion of the intervention sessions (32 sessions). The short sensory profile-2 was used to assess the post-test scores in both the control and experimental group participants to find out the effect of modified sensory board games on sensory processing among children with an autism spectrum disorder.

### Intervention Protocol

**Control Group:** Tactile based activities such as stringing beads, clay molding, play dough with the treasure hunt, Balloon painting, finger painting, brushing, water balls activities, shape boards, screwing and unscrewing

**Experimental Group:** Here the children in the experimental group underwent intervention with a modified sensory board game along with occupational therapy intervention.

The duration of each session was 45 minutes, where 20 minutes for occupational therapy intervention was given along with 20 minutes of modified sensory board game intervention with a 5 minutes rest in between.

The outcome was to develop adaptive interaction which will occur between the participant and the environment (including other people) in which the person meets the demands of the tasks

## DATA ANALYSIS AND RESULT

### Statistical method:

A quantitative study was carried out by the analysis of inferential statistics in this study. Mean and Standard deviation (Minimum-Maximum) were used as measurement criteria on a repeated basis for the result. The analysed data was used by SPSS software version 23. The descriptive statistics examined records distribution to summarise the data. The results were measured and categorised in number (%). Since the samples belonged to the sample size (of 30), a non-parametric method was used to test the statistical differences between pre-test and post-test scores of the control and experimental groups. Wilcoxon signed-rank test and Mann Whitney U test were analysed in finding the hypothesis being tested and identifying whether there exists a statistically significant difference in consideration of the treatment given. An alpha level of  $P = 0.05$  was measured to be statistically significant. The statistical analysis was done with the help of IBM SPSS version 23.0.

### DIFFERENCE BETWEEN PRE-TEST AND POST-TEST SCORES:

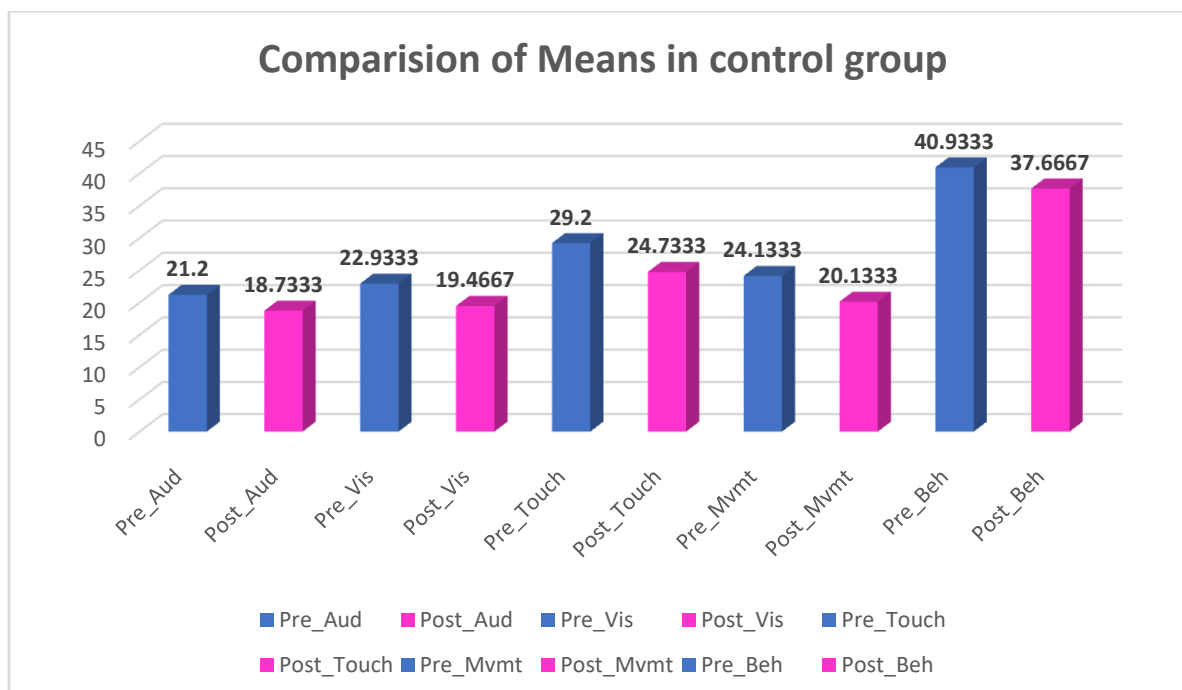
**Wilcoxon on signed-rank test** was performed to find the significant difference between Pre-test and post-test scores. 5% level of significance was observed.

**Table No: 1: Statistical analysis of pre-test and post-test in the control group**

| Group         |                | Mean    | N  | Z value | p-value |
|---------------|----------------|---------|----|---------|---------|
| Control group | Pre-Auditory   | 21.2    | 15 | -3.475  | 0.001*  |
|               | Post-Auditory  | 18.7333 | 15 |         |         |
|               | Pre-Visual     | 22.9333 | 15 | -3.43   | 0.001*  |
|               | Post-Visual    | 19.4667 | 15 |         |         |
|               | Pre-Touch      | 29.2    | 15 | -3.44   | 0.001*  |
|               | Post-Touch     | 24.7333 | 15 |         |         |
|               | Pre-Movement   | 24.1333 | 15 | -3.432  | 0.001*  |
|               | Post-Movement  | 20.1333 | 15 |         |         |
|               | Pre-Behaviour  | 40.9333 | 15 | -3.429  | 0.001*  |
|               | Post-Behaviour | 37.6667 | 15 |         |         |

\*Significant at 5% alpha level

Since the p-value is lesser than 0.05 in all 5 categories (Auditory, Visual, Touch, Movement, and Behaviour), an alternate hypothesis is accepted. Hence, there is a statistically significant difference between pre-test and post-test scores in the Control Group of the SSP Scale. This suggests that the conventional OT intervention received by the control group had significant improvement.



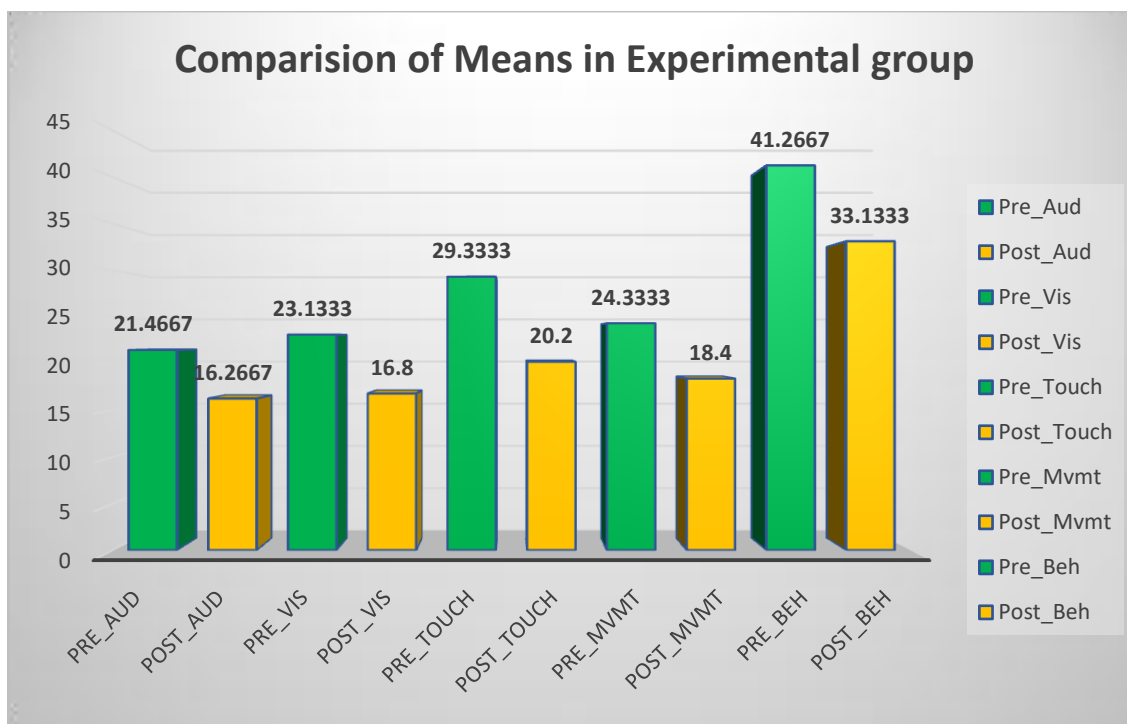
**Figure No: 1: Comparison between pre-test and post-test of the control group**

**Table No: 2: Statistical analysis of pre-test and post-test in the experimental group**

|                    |                | Mean    | N  | Z value | p-value |
|--------------------|----------------|---------|----|---------|---------|
| Experimental group | Pre-Auditory   | 21.4667 | 15 | -3.689  | 0.000*  |
|                    | Post-Auditory  | 16.2667 | 15 |         |         |
|                    | Pre-Visual     | 23.1333 | 15 | -3.43   | 0.001*  |
|                    | Post-Visual    | 16.8    | 15 |         |         |
|                    | Pre-Touch      | 29.3333 | 15 | -3.42   | 0.001*  |
|                    | Post-Touch     | 20.2    | 15 |         |         |
|                    | Pre-Movement   | 24.3333 | 15 | -3.417  | 0.001*  |
|                    | Post-Movement  | 18.4    | 15 |         |         |
|                    | Pre-Behaviour  | 41.2667 | 15 | -3.422  | 0.001*  |
|                    | Post-Behaviour | 33.1333 | 15 |         |         |

\* Significant at 5% alpha level

In the Experimental group, Since the p-value is lesser than 0.05 in all 5 categories (Auditory, Visual, Touch, Movement, and Behaviour), an alternate hypothesis is accepted. Hence, there is a statistically significant difference between pre-test and post-test scores in the Experimental Group of the SSP Scale. This suggests that the Modified Sensory board with Conventional OT intervention received by the experimental group had significant improvement.



**Figure No: 2: Comparison between the pre-test and post-test of the experimental group**

#### Difference between Experimental and Control Group

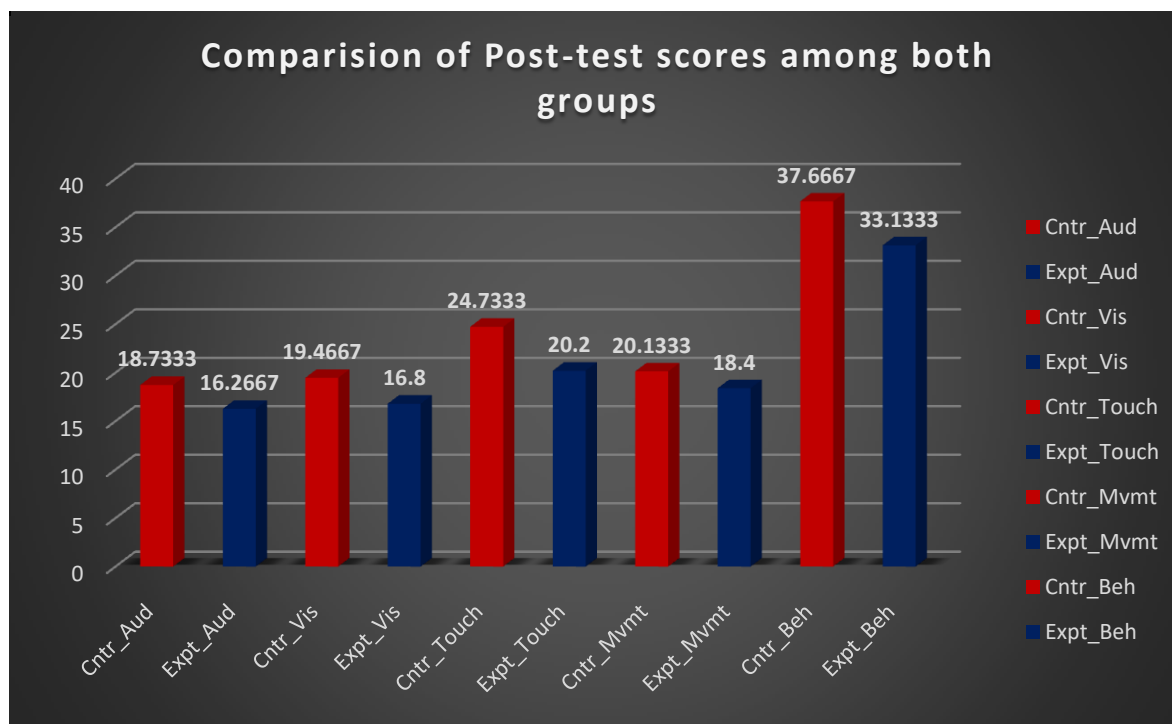
Mann Whitney U was performed to find the significant difference between Experimental and Control group. 5% level of significance was observed

**Table No: 3 Statistical Analysis between the post-test scores of the control and experimental group**

|           |                      | Mean    | N  | Z value | p-value  |
|-----------|----------------------|---------|----|---------|----------|
| Post test | Control-Auditory     | 18.7333 | 15 | 2.50942 | 0.01208* |
|           | Experiment-Auditory  | 16.2667 | 15 |         |          |
|           | Control-Visual       | 19.4667 | 15 | 2.9242  | 0.0035*  |
|           | Experiment-Visual    | 16.8    | 15 |         |          |
|           | Control-Touch        | 24.7333 | 15 | 4.02337 | 0.000*   |
|           | Experiment-Touch     | 20.2    | 15 |         |          |
|           | Control-Movement     | 20.1333 | 15 | 2.5509  | 0.01078* |
|           | Experiment-Movement  | 18.4    | 15 |         |          |
|           | Control-Behaviour    | 37.6667 | 15 | 4.3552  | 0.000*   |
|           | Experiment-Behaviour | 33.1333 | 15 |         |          |

\*Significant at 5% alpha level

Since the p-value is lesser than 0.05 in all 5 categories (Auditory, Visual, Touch, Movement, and Behaviour), an alternate hypothesis is accepted. Hence, there is a statistically significant difference in post-test scores between the Experimental and Control Group of the SSP Scale. This suggests that the intervention received by the experimental group had more improvement when compared to the control group.



**Figure No: 3 Comparison between post-test of the Control and Experimental group**

## DISCUSSION

The previous study has indicated that children with ASD have problems in processing, integrating, and responding to particular stimuli, which is necessary for performing functional tasks. The main purpose of the study was to determine the impact of the modified sensory board game to enhance sensory processing among children with ASD. The results indicated significant increases in sensory processing levels for participants with ASD after participation in the intervention with the modified sensory board game.

**Table 1 and figure 1** ( $P < 0.05$ ) presented a significant difference between pretest and post-test scores in the control group. The children in the control group attended the special school which mainly focused on their occupational therapy intervention along with their academic performance.

Similar to this, a previous study was conducted by **Babak Kashefimehr, HülyaKayhan, and Meral Huri**. In this study intervention, the therapist creates activities that encourage the child's participation and challenge his sensory processing and motor planning skills. The therapist also designs a "just-right" challenge (i.e., an activity that requires the best of the child's skills and abilities) from the child's repertoire of skills and supports his adaptive responses to the challenge. They suggested that SIT is often provided in a specially designed clinical environment using specific equipment (e.g., swings, therapy balls, inner tubes, trampolines, and climbing walls) that can provide tactile, proprioceptive, and vestibular challenges embedded in goal-directed, purposeful, and playful activities. In the current study, a similar strategy was used for the control group. Individualized play-based activities and sensory-enhanced interactions were used to elicit the child's adaptive responses in the therapy intervention, which was utilized for all the participants in this particular group.

**Table 2 and figure 2** ( $P < 0.05$ ) revealed a highly significant difference between pretest and post-test values in the experimental group, which proved the effect of modified sensory board games in enhancing sensory processing in children with an autism spectrum disorder.

Similar to this study, a previous study conducted by **Rosean e.schaaf, Janee Hunt, and Teal Benerides(2012)**, Where results provide preliminary evidence of the efficacy of OT using a manualized protocol based on the principle of SI for children with an Autism spectrum disorder. Given the relatively brief intervention period of 10 weeks, these findings are particularly interesting and maybe strengthened even further with a longer intervention period. In addition, it demonstrates the implementation of a manualized protocol with hypothesis generation. In the current study, the treatment protocol was given for 12 weeks and is based on manualized protocol only.

**Table 3 and figure 3** ( $p < 0.05$ ) revealed highly significant differences between the post-test scores of the control and experimental. The study finding shows that the Intervention with the Modified Sensory Board game was much

more effective than the conventional Occupational therapy intervention among children with ASD (Autism spectrum Disorder)

The findings of the study were consistently based on a previous study by **Sandra Barker Dunbar(2012)**, In which they conducted a study to evaluate the outcome differences between traditional integration treatment and Integrated sensorimotor activities for preschool children with Autism spectrum Disorder. Results concluded that a Sensory rich environment with structured Sensing Activities included does have the potential for children to improve overall play skills among children with autism. In our current study, a Sensory-Rich environment with structural activity was provided in the form Modified Sensory Board game.

### **CONCLUSION**

Children with ASD often present with difficulty processing and integrating sensory information ( **Baranels, David, Poe, stone, and Watson, 2006; Mailloux and smith roley, 2010**) which has an impact on their adaptive behavior and participation in daily activities. Therefore, it is essential to enhance sensory processing in children with ASD.

The study investigated the impact of modified sensory board games on sensory processing among children with ASD. 30 children with ASD were included as members of the experimental group. Underwent intervention with a modified sensory board game along with conventional OT whereas the 15 members of the control group Underwent only conventional OT.

Based on the analysis of the obtained results, concluded that the intervention with a modified sensory board game Proved effective in enhancing the sensory Processing of children with ASD. The Modified sensory Board game also successfully has shown improvement in play skills and also attention and concentration skills for children with ASD as referred by the teachers.

The Results of this study proved the Impact of modified Sensory board games on sensory processing among children with ASD.

### **LIMITATIONS**

1. The study was conducted in a small population
2. This study was done only for children with autism spectrum disorder (aged 4-8 years)

### **RECOMMENDATIONS**

1. This study recommended continuing follow-up of participants to identify the effect of modified sensory board games on sensory processing, which might further impact their behaviour.
2. This study can be carried out for other conditions and populations and different aged groups.
3. This study can be performed with a larger sample size.
4. We can also try to modify other board games according to the sensory processing deficit

**Source of Funding:** Self

**Conflicting Interest:** None

**Ethics Clearance:** Approval from Institution Scientific Review Board (ISRB) was obtained prior to the study.

### **REFERENCES**

- [1]. **Case-Smith, J., Weaver, L. L., &Fristad, M. A. (2015).** A systematic review of sensory processing interventions for children with autism spectrum disorders. *Autism: the international journal of research and practice*, 19(2), 133–148. <https://doi.org/10.1177/1362361313517762>
- [2]. **Marco, E. J., Hinkley, L. B., Hill, S. S., & Nagarajan, S. S. (2011).** Sensory processing in autism: a review of neurophysiologic findings. *Pediatric Research*, 69(Pt2), 48R–54R. <https://doi.org/10.1203/PDR.0b013e3182130c54>.
- [3]. **Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011).** Effectiveness of sensory integration interventions in children with autism
- [4]. spectrum disorders: a pilot study. *The American journal of occupational therapy: official publication of the American Occupational Therapy Association*, 65(1), 76–85. <https://doi.org/10.5014/ajot.2011.09205>
- [5]. **Jane Case-Smith, Teresa Bryan;** The Effects of Occupational Therapy with Sensory Integration

- Emphasis on Preschool-Age Children With Autism. *Am J Occup Ther* 1999;53(5):489–497. <https://doi.org/10.5014/ajot.53.5.489>
- [6]. **Schaaf, R. C., & Case-Smith, J. (2014).** Sensory interventions for children with autism. *Journal of comparative effectiveness research*, 3(3), 225–227. <https://doi.org/10.2217/cer.14.18>
- [7]. **Jadhav, A. (2016).** Effect of Texture on Autistic Children. *Academia*. [https://www.academia.edu/36128996/Effect\\_of\\_Texture\\_on\\_Autistic\\_Children](https://www.academia.edu/36128996/Effect_of_Texture_on_Autistic_Children)
- [8]. **Ayres AJ (1972)** Sensory Integration and Learning Disorders. Los Angeles, CA: Western Psychological Services.
- [9]. **Fazlioglu Y and Baran G (2008)** A sensory integration therapy program on sensory problems for children with autism. *Perceptual and Motor Skills* 106: 115– 422.
- [10]. **Schaaf RC, Hunt J and Benevides T (2012).** Occupational therapy to improve participation of a child with autism: A case report. *American Journal of Occupational Therapy*: 66, 547–555
- [11]. **Lane SJ (2002) Sensory modulation. In Bundy AC, Lane SJ and Murray EA (eds) Sensory Integration: Therapy and Practice.** 2nd ed. Philadelphia, PA: F.A. Davis, pp. 35–70.
- [12]. **Klintwall L, Holm A, Eriksson M, et al. (2011)** Sensory abnormalities in autism: a brief report. *Research in Developmental Disabilities* 32: 795–800.
- [13]. **American psychiatric association.** Diagnostic and Statistical Manual of Mental Disorders: DSM-5. Washington, D.C. American Psychiatric Association; 2013.
- [14]. **Simmons, K. L., & Grandin, T. (2006b).** The Official Autism 101 Manual [E-book]. Autism Today.
- [15]. **Smith, Jane Case, and Jane Clifford O'Brien.** Occupational therapy for children. Elsevier Health Sciences, 2010.