




# Comparison of the Effectiveness of Sexual Education and Sensory, Proprioceptive, and Tactile Exercises on Children's Attachment Styles

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## ABSTRACT

**Objective:** This study aimed to compare the effectiveness of sexual education and sensory, proprioceptive, and tactile exercises on children's attachment styles.

**Methods and Materials:** The study employed a quasi-experimental design with pre-test, post-test, and follow-up measurements. Thirty children aged 4 to 7 years were selected from five therapeutic clinics in Tehran using convenience sampling and were randomly assigned to two experimental groups (sexual education and sensory exercises) and a control group. Data were collected using the Randolph Attachment Disorder Questionnaire and the Sensory Integration and Praxis Tests (SIPT). The experimental groups received their respective interventions for five months, while the control group received no intervention. Data were analyzed using two-way repeated measures ANOVA, and Bonferroni post-hoc tests were applied for pairwise comparisons.

**Findings:** The results revealed a significant decrease in attachment disorder scores in the post-test and follow-up phases for both experimental groups compared to the pre-test, while the control group showed no significant changes. The difference between the post-test and follow-up scores was not significant, indicating the stability of the treatment effects over time. Sexual education and sensory, proprioceptive, and tactile exercises were effective in reducing attachment disorders and promoting secure attachment in children.

**Conclusion:** Both sexual education and sensory exercises can be considered effective interventions for enhancing secure attachment in children.

**Keywords:** *sexual education, sensory exercises, proprioceptive exercises, tactile exercises, attachment styles.*

## 1. Introduction

In today's world, attention to children's emotional and psychological development has gained special importance (Khorrami Nobandi & Yaghoubi Pour, 2024). One of the key aspects of this development is attachment styles, which play a vital role in shaping children's social and emotional relationships (Vafakar & Ali Akbari Dehkordi, 2024). Attachment styles can significantly affect the ability to form effective and lasting relationships in future life (Hart & Risley, 2020).

Attachment generally refers to the deep emotional and psychological bond formed between a child and their primary caregiver. This bond can serve as a foundation for the development of psychological and emotional security, helping children cope effectively with life's challenges (Kim & Kim, 2022). Attachment, as a complex phenomenon, includes various dimensions, such as secure and insecure attachment (Deini & Sasani, 2024). Secure attachment is defined as a healthy and positive relationship between the child and the caregiver, where the child feels safe and assured (Nourian et al., 2022). In contrast, insecure attachment is characterized by an unhealthy and negative relationship where the child feels insecurity and fear (Larkin & Shields, 2021).

Research findings indicate that secure attachment is associated with healthy psychological and social development in children. Children with secure attachment, compared to those with insecure attachment, exhibit higher levels of positive self-concept and social and emotional abilities; in contrast, insecure attachment is associated with various psychological and social issues in children (Murray & Trevarthen, 2019). In other words, if secure attachment fails to develop, children may face issues such as separation anxiety, lack of self-confidence, and difficulties in forming social relationships. These problems can have long-term effects on their psychological and social well-being (Shonkoff & Phillips, 2020).

One of the critical factors influencing the development of children's attachment is sexual education (Roberts, 2018). Sexual education is defined as an educational process that helps children acquire the necessary knowledge and skills to develop sexual identity and establish healthy relationships. Research findings suggest that sexual education plays an important role in fostering secure attachment in children (American Academy of Pediatrics, 2020).

According to a study by Roberts (2018), sexual education can significantly influence children's attachment. The

results showed that children who received sexual education demonstrated more secure attachment compared to those in other groups (Roberts, 2018). Sexual education, as one of the important educational methods, can effectively enhance children's awareness and foster healthy relationships (Aghababaei & Namdarpoor, 2024). These teachings not only provide essential information about the body and sexuality but also help children recognize their personal boundaries and defend them in interpersonal relationships (World Health Organization, 2010).

Sensory, proprioceptive, and tactile exercises are also recognized as strategies for enhancing neural connections and improving sensory-motor coordination in children (Dunn, 2022). These exercises can help children better manage their sensory experiences and use them to build stronger relationships (Ben-Sasson et al., 2017).

Research findings suggest that sensory, proprioceptive, and tactile exercises can significantly affect children's attachment. The study findings revealed that children who received sensory, proprioceptive, and tactile exercises demonstrated greater secure attachment and a reduction in insecure attachment (Johnson & et al., 2018). Sensory exercises emphasize stimulating various senses such as vision, hearing, smell, taste, and touch. These exercises involve activities like touching different objects, hearing various sounds, smelling fragrances, tasting different flavors, and observing images and colors (Dunn, 2022).

Proprioceptive exercises focus on enhancing depth perception and spatial understanding (Kord et al., 2024). These activities include throwing and catching objects, body movements in space, playing with puzzles, and shaping objects (Murray & Trevarthen, 2019). Tactile exercises emphasize strengthening the sense of touch and recognizing the texture and shape of objects. These activities involve touching various objects, playing with clay and plasticine, and painting and drawing. These exercises can help children enhance their sensory perceptions, improve attachment, and strengthen their social and emotional relationships (Miller et al., 2018).

Given this, identifying and analyzing effective methods for strengthening secure attachment and reducing insecure attachment in children is of great importance (Talebian Sharif et al., 2023). By comparing the effectiveness of sexual education and sensory, proprioceptive, and tactile exercises on children's attachment styles, this study can assist parents, educators, and child psychology specialists in selecting and applying more effective methods for fostering secure attachment. Ultimately, it can lead to improved quality of

life and social relationships for children. This research aims to answer the important question: "Are sexual education and sensory, proprioceptive, and tactile exercises effective in influencing children's attachment styles

## 2. Methods and Materials

### 2.1. Study Design and Participants

The present study is applied in nature and quasi-experimental in terms of data collection, with a pre-test and post-test design with a control group. The statistical population consisted of children aged 4 to 7 years from five therapeutic clinics in Tehran. Through convenience sampling, 30 children were selected as the sample and randomly assigned to two experimental groups (10 in each group) and one control group (10 participants). The research instruments included the Sensory Integration and Praxis Test (SIPT), Randolph's Attachment Disorder Questionnaire, a sexual education training package for parents (10 sessions, 60 minutes each over five months), and an integrated sensory stimulation package for children aged 4 to 7 years (18 sessions, 60 minutes each over five months). For data analysis, the statistical method of two-way repeated measures analysis of covariance (mixed between-within subjects design) was used.

The inclusion criteria for the study consisted of insecure attachment styles, as measured by a questionnaire, the age range of 4 to 7 years, written informed consent for participation in therapy sessions, no severe psychological disorders, and the cooperation of parents and children. The exclusion criteria included: loss of any inclusion criterion during the study, absence from educational sessions, and lack of interest in continuing participation.

To collect information, the Randolph Attachment Disorder Questionnaire and Sensory Integration and Praxis Test (SIPT) were utilized, along with two educational protocols on sexual education and sensory stimulation.

### 2.2. Measures

#### 2.2.1. Sensory Integration

This questionnaire consists of 110 questions that assess sensory integration across five different dimensions: visual integration, auditory integration, tactile integration, olfactory integration, and gustatory integration. It includes subscales such as social communication, verbal communication, imitation skills, imitation in children's play, and specific signs of autism. The questionnaire was designed

by Zeyer in 1994 and is considered a reliable tool for assessing sensory integration in children and adults. This questionnaire helps parents or caregivers to gain a better understanding of their child's sensory abilities and identify any disorders or issues in this area (Safari, 2021).

#### 2.2.2. Attachment Style

Randolph Attachment Disorder Questionnaire is a 30-item checklist completed by the child's parents or caregivers, covering a variety of problems observed by the caregiver over the past two years. During the standardization process conducted by Movahed Abtahi, the number of items was reduced to 25, and it is based on the Likert scale. This questionnaire assesses three factors: bullying, impulsivity, and antisocial behaviors. The original scoring ranges from 65 to 75 indicating mild attachment disorder, 76 to 89 indicating moderate attachment disorder, and scores above 90 indicating severe attachment disorder. In contrast, children scoring between 60 to 65 may have attachment issues but do not fully exhibit symptoms of attachment disorder. The validity and reliability of this questionnaire were confirmed in a study by Eslami, Malekzadeh, and Pirmoradian (2023) with a Cronbach's alpha of 0.82 (Eslami et al., 2023).

### 2.3. Interventions

#### 2.3.1. Sexual Education Training Package for Parents

The sexual education package for parents was divided into 10 topics and 10 educational sessions, each lasting 60 minutes over a period of 5 months, moving from less sensitive to more sensitive topics. The Bezanoff Health Promotion Model is a practical and appropriate model for conducting health education and promotion interventions. The components of the Bezanoff model include behavior, attitude, abstract norms, and enabling factors. The influence of demographic factors such as age, gender, education, religious literacy, and occupation on these components is significant (Aghababaei & Namdarpoor, 2024; Ghorbani, 2016; Kord et al., 2024).

#### 2.3.2. Sensory Stimulation Educational

This educational package was implemented in 18 sessions of 60 minutes over 5 months for the educational groups. Sensory integration therapy refers to the ability to organize the sensory information received from various senses and manage this information using active brain mechanisms.

This includes stimulating the sense of touch through skin contact with various materials, vestibular and proprioceptive senses through physical activities, and combining different sensory inputs. This therapeutic method, which can take the form of play therapy, occupational therapy, or speech therapy, helps children utilize sensory information more effectively. Reflexology training, sensory stimulation, and massage were taught to parents in various sessions to apply to children. Reflexology is a technique based on the idea that reflex points exist on the palms, soles, ears, etc., which correspond to every part of the body, including muscles, nerves, glands, and bones. Applying pressure to these points reduces tension, helps calm the nerves, and relaxes the body (Safari, 2021).

#### 2.4. Data analysis

For data analysis, descriptive statistics concerning variables such as the level of education, age, number of children, and occupation of parents in the sample were examined. Subsequently, the statistical assumptions were assessed, and repeated measures analysis was used. The data were coded and entered into SPSS 26 software, and the results were analyzed at a significance level of .05.

### 3. Findings and Results

Descriptive findings of the study variables are presented below (Table 1).

**Table 1**

*Descriptive statistics of attachment disorder scores across three measurement phases, by group*

Group	Variable	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Follow-up Mean	Follow-up SD
Control	Bullying	23.13	2.503	23.20	2.651	23.60	2.849
	Impulsivity	21.53	2.167	21.13	3.335	21.40	3.376
	Antisocial Behaviors	28.53	2.475	28.07	2.549	28.33	5.381
	Total Attachment Disorder	73.20	4.074	72.40	5.180	73.33	6.986
Sensory, Proprioceptive, & Tactile Exercises	Bullying	22.53	2.200	18.87	2.532	19.40	2.823
	Impulsivity	21.60	1.920	17.47	1.922	18.07	2.314
	Antisocial Behaviors	28.13	2.446	23.67	3.416	23.73	3.882
	Total Attachment Disorder	72.27	4.217	60.01	4.706	61.20	4.724
Sexual Education	Bullying	22.93	2.434	15.27	3.218	15.80	3.610
	Impulsivity	20.93	1.981	14.20	2.624	14.73	3.058
	Antisocial Behaviors	27.73	2.764	20.20	2.859	20.60	3.418
	Total Attachment Disorder	71.60	4.306	49.67	6.298	51.13	7.230

As observed, in the control group, the mean scores from the pre-test to the post-test and follow-up phases show little change. However, in the experimental groups, there is a reduction in scores in the post-test and follow-up phases compared to the pre-test. To assess the effectiveness of sexual education on children's attachment disorder, a two-way repeated measures ANOVA was used (Table 1).

The results of Levene's test were not significant, confirming the assumption of homogeneity of variances. Moreover, Mauchly's test of sphericity was statistically significant, indicating a violation of the sphericity assumption. Violation of this assumption increases the likelihood of Type II error, thus making the significance

values in the multivariate test unreliable. Therefore, the Greenhouse-Geisser and Huynh-Feldt corrections, which adjust the degrees of freedom, were applied.

The results of the multivariate tests to compare the mean scores of attachment disorder between the control and sexual education groups across treatment stages indicate that all multivariate tests were significant. This suggests the existence of a main effect related to the repetition factor (pre-test, post-test, and follow-up), as well as an interaction effect between the groups and repetition (i.e., a difference between the groups across measurement stages). To further compare the mean scores between the stages, the Bonferroni post-hoc test was used, and the results are presented below (Table 2).

**Table 2**

*Bonferroni post-hoc test results*

Group	Dependent Variable	Stage 1	Stage 2	Mean Difference	Standard Error	Significance Level
Control	Bullying	Pre-test	Post-test	-.067	0.409	1
			Follow-up	-.467	0.446	0.912
		Follow-up		-.400	0.336	0.730
	Impulsivity	Pre-test	Post-test	-1	0.982	0.952
			Follow-up	0.133	0.426	1
		Follow-up		1.133	1.207	1
Sexual Education	Bullying	Pre-test	Post-test	7.667	0.409	0.001
			Follow-up	7.133	0.446	0.001
		Follow-up		-.533	0.336	0.370
	Impulsivity	Pre-test	Post-test	6.067	0.982	0.001
			Follow-up	6.200	0.426	0.001
		Follow-up		0.133	1.207	1
Sexual Education	Antisocial Behaviors	Pre-test	Post-test	7.533	0.456	0.001
			Follow-up	7.133	0.926	0.001
		Follow-up		-.400	0.791	1

In Table 2, pairwise comparisons were made to examine the differences in attachment disorder scores during the treatment stages for each control and sexual education group. Based on the results, the differences between the mean scores from the pre-test to the post-test and follow-up stages in the sexual education group are significant ( $p < .05$ ). Comparing the mean scores across the three stages reveals a

significant decrease in attachment disorder scores in the post-test and follow-up phases compared to the pre-test. The difference between the post-test and follow-up scores is not significant ( $p > .05$ ), indicating the stability of treatment effects over time. In the control group, no significant differences were found between the scores from the pre-test, post-test, and follow-up phases ( $p > .05$ ).

**Table 3**

*Results of between-subject effects for comparing attachment disorder mean scores across groups*

Source of Variation	Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Group	Bullying	634.678	1	634.678	27.639	0.001
	Impulsivity	557.511	1	557.511	59.021	0.001
	Antisocial Behaviors	672.400	1	672.400	25.783	0.001
Error	Bullying	642.978	28	22.963		
	Impulsivity	264.489	28	9.446		
	Antisocial Behaviors	730.222	28	26.079		

In Table 3, the results of between-subject effects for comparing the mean scores of attachment disorder between the control and sexual education groups are presented. The

F values for all attachment disorder components were significant ( $p < .01$ ).

**Table 4**

*Bonferroni post-hoc test results*

Dependent Variable	Group 1	Group 2	Mean Difference	Standard Error	Significance Level
Bullying	Control	Sexual Education	5.311	1.010	0.001
Impulsivity	Control	Sexual Education	4.978	0.648	0.001
Antisocial Behaviors	Control	Sexual Education	5.467	1.077	0.001



In [Table 4](#), pairwise comparisons for examining the mean scores of attachment disorder between the control and sexual education groups are provided. Based on the results, the mean attachment disorder scores in the sexual education group are significantly lower than those in the control group ( $p < .05$ ).

#### 4. Discussion and Conclusion

This study aimed to compare the effectiveness of sexual education and sensory, proprioceptive, and tactile exercises on children's attachment styles. The results of the study showed that comparing the mean scores across the three stages revealed a significant decrease in the mean scores of attachment disorder in the post-test and follow-up phases compared to the pre-test phase in the experimental groups, in contrast to the control group. The difference between the post-test and follow-up scores was not significant, indicating the stability of the treatment over time. This demonstrates the effectiveness of sensory, proprioceptive, and tactile exercises on attachment disorders in children, confirming the hypothesis.

The findings are consistent with prior studies ([Eshghi & Bostani, 2019](#); [Ghorbani, 2016](#); [Mubarak et al., 2017](#); [Safari, 2021](#); [Sinclair et al., 2020](#); [Walbam, 2019](#)). These researchers found a positive relationship between sensory stimulation (sensory diet) and attachment style using sensory diet interventions. Individuals with sensory processing disorders face difficulties such as managing emotions, behavior, and motor control ([Lamb & Gilbert, 2020](#)). Sensory stimulation enhances children's self-concept, improves social skills, and reduces behavioral problems ([Fine & McClelland, 2021](#)). A study that examined the effects of a sensory diet on sensory processing skills, psychosocial skills, and classroom participation in children showed positive effects of the sensory diet ([Safari, 2021](#)). Although attachment is associated with sensory modulation among children and adolescents, and insecure attachment is linked to pain severity in adolescents, the relationships between sensory modulation, attachment, and functioning in a clinical sample of children and adolescents with chronic pain have not been clearly demonstrated ([Safari, 2021](#); [Walbam, 2019](#)).

A study conducted to determine the effects of gentle touch on the behavioral responses of premature infants showed that gentle touch can be used as an effective method to increase sleep states, reduce restlessness, and mitigate the

adverse effects of stressors in neonatal intensive care units ([Eshghi & Bostani, 2019](#)). Another study investigating the effects of sensory integration exercises on the sensory profile of elementary school children with dyslexia and dysgraphia found that sensory integration exercises increased sensory profile factors such as sensory-seeking, emotional reactivity, oral sensory sensitivity, sensory inattention/distractibility, inactivity, and fine motor/perception skills in dyslexic children ([Dunn, 2022](#)).

A study aimed at determining the differences in attachment styles and childhood abuse experiences in patients with borderline personality disorder and healthy individuals, as well as predicting schema modes in borderline personality disorder patients based on childhood abuse and attachment styles, was conducted with 60 participants (30 patients with borderline personality disorder and 30 healthy individuals) selected through purposive sampling. The results supported Young's schema model and emphasized the role of negative parental upbringing and early negative relationships with parents in shaping maladaptive schema modes, suggesting that the formation of avoidant attachment styles and experiences of emotional and sexual abuse during childhood predispose individuals to borderline personality disorder in adulthood ([Hart & Risley, 2020](#); [Johnson & et al., 2018](#)).

Another study assessing the effectiveness of a sensory integration educational program on memory, attention, and problem-solving skills in children aged 1 to 3 years in a Shiraz orphanage indicated that sensory integration therapy could stimulate the nervous system and enhance problem-solving skills. Therefore, this therapy can be used to improve cognitive skills such as memory, attention, and problem-solving in children aged 1 to 3 years ([Safari, 2021](#)). In explaining attachment theories, Ainsworth proposed three phases of separation: protest, despair, and detachment, in children's reactions following separation from caregivers. These reactions are influenced by the quality of attachment before separation (e.g., touch, hugging, and caregiver availability) as well as the quality of caregiving experienced after separation ([Pourtaghi et al., 2022](#)).

Sexual education, which includes teachings on sexuality, the body, and personal boundaries, can play a crucial role in shaping children's attitudes and feelings about themselves and others ([Robinson et al., 2021](#)). On the other hand, sensory, proprioceptive, and tactile exercises, which focus on enhancing bodily sensation and physical connection, may help children experience greater security in their

relationships (Allen et al., 2022). Attachment theory, founded by John Bowlby, posits that the quality of a child's early interactions and relationships with their primary caregivers can have profound effects on their behavioral and emotional patterns throughout life (Hart & Risley, 2020).

By carefully analyzing the data collected from the research sample, this study aims to provide new insights that can help parents, educators, and child psychology specialists adopt more effective strategies for fostering and developing children's psychological health. It is suggested that one area for further research is the design and implementation of age-appropriate sexual education programs. These programs should be designed in a way that involves both parents and educators in the teaching process, utilizing interactive methods and educational games to help children better understand basic concepts of sexuality and personal boundaries. Implementing such programs can help children develop a better understanding of their bodies and social interactions related to gender, which can ultimately impact their attachment styles and promote healthier relationships.

Additionally, sensory, proprioceptive, and tactile exercises, as another component of this study, can be used as tools to strengthen the parent-child relationship. These exercises, including activities such as infant massage, tactile games, and proprioceptive exercises, can help children feel more secure and accepted. Planning workshops for parents to teach them how to implement these exercises and monitor their child's progress can improve the quality of parent-child interactions and promote the development of secure attachment styles in children.

## 5. Limitations & Suggestions

One limitation of this study was the lack of control over certain variables such as the duration of the patient's illness and the psychological condition of the caregivers, which may have influenced the results. Based on the findings of this study, which demonstrated the effectiveness of EFT on the dependent variables, it is recommended that workshops and programs be conducted in psychological and counseling centers, as well as other centers that work with chronic patients, to raise awareness and provide more comprehensive education in this area.

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## Declaration of Interest

The authors of this article declared no conflict of interest.

## Ethical Considerations

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

## Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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## Authors' Contributions

All authors equally contributed in this article.

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