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Sensory Development in Children and Supportive Suggestions: "Child Development Perspective"

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Abstract: People receive stimuli from their body and the environment through sensory organs, specialized for sensations and the receptors that these organs contain. Stimuli are perceived through the receptors, which receive and transmit the stimuli to the relevant centers of the brain. A healthy functioning sensory system increases the quality of life of the individual in accordance. Considering the speed of brain development, especially in infancy and preschool period, and the mediating role of the senses in exploring the environment, it is important to systematically support the senses from an early age. However, the senses might not always develop to the expected extension and some sensory models might occur in return In such cases, sometimes behavioral outputs, caused by sensory model in the face of a problem could only be described as a behavioral problem. Being aware of this situation, providing appropriate assessment and support to children, involving parents in the process, and conducting the process in a transdisciplinary approach with field experts, who study with the child (child development specialist, occupational therapist, physiotherapist, etc.) would provide positive outcomes in order to enhance early intervention and support child development. In this article, which emphasizes the importance of supporting sensory development from a child development perspective, the functioning of sensory systems, understanding children's sensory models and the supports that could be provided in this context are included.

Introduction

The senses are the bridges that serve as a functional framework for the acquisition of basic life skills while mediating the child's interaction with the outside world, in regards to the recognition of his/her own body to explore the environment.

Sense is the neurophysiological energy that appears when receptor cells are stimulated under the influence of physical energy in the external world. As a result of the processing of this neural energy in the brain, perception emerges with the organization and interpretation of sensory data (Özata, 2015, p. 2). In this context, perception is the interpretation of how events and objects are perceived in the environment (Santrock, 2018, p. 132). Experience plays a key role in the perception of individuals (Özata, 2015, p. 2). Experience, realized using the senses are pioneers, in recognizing and comprehending the environment. Senses, which are the main tool for exploring the environment while still in the newborn period, should be supported from the first years of life as they play a preparatory role in life (Uyanık-Balat et al., 2005, p. 9). In the process of healthy development, the senses taken from the body are as important as the senses taken from the environment. Since the senses received from the body enable the individual to behave in a

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balanced manner, to adjust body position and to perceive information from the internal organs.

The meaningfulness of the sensations, received from the body and the environment, depends on the functional functioning of the sensory organs and the coordinated functioning of the central and peripheral nervous system without any damage. Considering the direct effect of a possible damage issue on the development of the senses, it is predicted that it would negatively affect the whole life of the individual from daily routine work to social relations (Çetin-Sultanoğlu & Aral, 2015). In a study analyzing the studies conducted in this context (Costa-López et al., 2021), it was reported that high levels of sensory sensitivity negatively affect health, well-being, social, emotional, physical and mental areas. Therefore, it is important to identify sensory problems at an early stage and provide the necessary support in order to positively affect the individual's life in the following period. In this context, having a conscious approach to sensory problems is very important in terms of increasing the effectiveness of the therapy process (Çetin-Sultanoğlu & Aral, 2015). As a matter of fact, studies on sensory problems show that therapies provide positive outcomes on children (Patil & Kaple, 2023; Raditha et al., 2023).

When experts and families have sufficient knowledge about sensory development and sensory processing, they could be conscious to adapt sensory-supportive activities to their daily routines according to children's sensory characteristics. This awareness-based approach enables children to have successful experiences (Dunn, 2007). This could also contribute to children's sensory motor, social and cognitive development (Dunn, 1997). In this context, for example, in Beşir's study (2020) conducted in a baby library, it was found that the sensory experiences training program prepared for sensory development had a positive and significant effect on infants' senses of sight, hearing, touch and smell, as well as language, cognitive, fine-motor and social-emotional development areas. In another study (Akagündüz & Aksoy, 2020), it was found that the sensory training program contributed to the fine and motor development areas of infants. As could be seen, although the results of these and similar studies (Cascio et al., 2019; Koyuncuoğlu, 2017; Yazıcı, 2013) indicate that the study results have positive outcomes on children, although the studies are relatively few, there is no current research in the literature that comprehensively reveals the different sensory characteristics of children with typical development and offers supportive suggestions. As a matter of fact, Alisinanoğlu and Bartan (2022) examined the scientific studies on sensory education in the field of preschool and child development in Turkey and reported that the studies were quite few and were primarily conducted in the fields of occupational therapy, physiotherapy and special education. Moreover, in the literature, most of the studies on sensory support and therapy were conducted for children with atypical development, especially children with autism, and studies, indicating that this support has positive effects on children (e.g., Başcan, 2021; Unay et al., 2020; Patil & Kaple, 2023; Raditha et al., 2023).

Dunn (2007) stated that individuals with typical development could also give sensory responses like individuals with atypical development. The study results of Little et al. (2018) showing that children with typical development also have different sensory models are evidence for this. It should also be noted that a person could have more than one sensory model. Considering different sensory systems, a person might be sensitive to touch while showing low register to sounds (Dunn, 2007). In this context, the study results of Pérez-Fonseca et al. (2019) provide evidence for this. In line with these results, when the sensory model of the child is recognized, the sensory needs of the child could be met by providing experiences for him/her and the opportunity to successfully participate in routines could be provided (Dunn, 2007).

In the light of the information provided, a literature review was conducted, and it was determined that there are a limited number of studies on sensory development. Accordingly, it was felt necessary to conduct this study to raise awareness for professionals working with children to better define the sensory models that children have and to create a developmental support plan suitable for the child and family in this direction. In the study, sensory models and supportive activity suggestions according to the models were discussed because of Dunn's sensory processing model, as it offers a broad perspective on this issue.

Sensory Systems: Sensory Organs and Functions

There are eight senses, categorized as external or environmental (hearing, sight, touch, smell, taste)

and internal or body awareness (vestibular/balance, proprioceptive/deep sensation, interoceptive/internal sensation) (Albayrak Sidar, 2020; Ayres, 2005, p.38; Polen-Akşimşek, 2020).

In the publications, related to the context based on this issue, it was found that seven senses (hearing, vision, touch, smell, taste, vestibular, proprioceptive) were generally mentioned, but since some publications (Albayrak Sidar, 2020; Ayres, 2005; Polen-Akşimşek, 2020) included the interoceptive sense, which is considered as the eighth sense, eight senses were mentioned in this study. In the senses section of this article, the senses were defined in terms of their anatomical structure and functioning, and a brief evaluation of their importance in the development process was made from a child development-based perspective.

Sense of Hearing

The sense of hearing involves hearing sounds from the environment through the ear and balance and it has two different functions: The first is hearing, which enables hearing through the ear, and the second is balance, which detects changes in head and body position. The ear, which is responsible for hearing and balance, consists of the outer, middle and inner ear (Kahle & Frotscher, 2009, p.366). Hearing is a physiological event that follows the process of transmitting and analyzing the sound waves coming from the environment to the brain by following the outer, middle and inner ear sequence. Listening is the perception and identification of sounds. In short, hearing and comprehending sounds are separate situations (Duman, 2015, p. 208, 209).

Sense of Sight

The sense of vision includes visual information transmitted through the eye to the brain for understanding and processing stimuli (Duman, 2015, p. 204). That is, visual sensory input is sent to the visual processing centers in the brain when light stimulates the retina. As a result of the processed inputs, basic awareness of the location of those in the environment is achieved (Ayres, 2005, p. 39).

Touch/Tactile Sensation

The sense of touch/ tactile sensation is the perception of different sensations such as contact, pressure, vibration, pain, heat, cold through receptors located in the skin, the largest and heaviest organ of the body, which also contains nails, hair, sweat and sebaceous glands (Aktümsek, 2009).

Sense of Smell

The sense of smell is realized through the transmission of small odor particles received from the environment through the nose as messages to the brain (Duman, 2015, p. 209). The fact that odor is processed through the limbic system without passing through typical brain system channels like other senses makes it unique. Because of this, odors could directly stimulate emotions (Ayres, 2005, p. 40).

Sense of Taste

The sense of taste is the sensation of the four basic taste sensations of sweet, salty, bitter and sour through the tongue via taste buds or receptors (Kahle & Frotscher, 2009, p.330, 332). In addition, two new tastes, "water taste" and "umami", the characteristic taste of chicken and beef broth, have emerged in humans (Aktümsek, 2009, p. 126).

The five external senses described above are very important in child development as they play a mediating role in children's exploration of the environment while contributing to brain development. It is thought that the child's use of multiple senses in the learning process increases the permanence of learning. In addition, the three internal senses mentioned below are also very important in child development as they enable the child to recognize the sensations coming from the body, that is, to move in a balanced way, to provide the appropriate body position, and to perceive situations such as pain, pain, and toilet coming from the internal organs. It is predicted that the perception of these situations could affect many situations such as the child's place in the social environment, self and personality development. Therefore, professionals and parents working with children should keep in mind that internal senses are as important

as external senses.

Vestibular Senses

Vestibular sense is the sense that allows the individual to adjust the ability to act in a balanced and coordinated manner, referring to balance, movement, speed, and to determine the speed and direction of the movement of the individual's body as well as the surrounding individuals and objects (Albayrak Sidar, 2020, p.78). In other words, the receptors of the sense of balance are located in the inner ear and enable to perceive the movement of the head and stand upright against gravity (Bumin, 2019, p. 154). Any child, who has drawbacks in the vestibular sense, might have difficulty in sitting balanced in a row, jumping, dancing and games that require coordination, appear clumsy, and bump into objects and people in the environment (Albayrak Sidar, 2020, p. 164, 165).

Proprioceptive Sensation

Proprioception refers to the bending, straightening, pulling and compressing of joints between bones by contraction and stretching of muscles (Ayres, 2005, p. 41). Proprioceptive sensation is the perception of the position of body and joint movements in space, reflecting the development of body awareness (Bumin, 2019, p. 153; Polen-Akşimşek, 2020, p. 59-61). In other words, it is the perception of sensations coming from one's own body. The lack of this sense in the body, which enables movement, slows down body movements and cumbersome, as well as requiring more effort. For example, inadequacy of this sense in the trunk and legs could lead to difficulties in descending steep stairs, getting in and out of an automobile, and playing sports, while inadequacy in the hands would lead to difficulties in buttoning a garment (Ayres, 2005, p. 41).

Interoceptive Sensation

Interoceptive sense is the sense that enables the perception of information from internal organs such as heartbeat, filling of the bladder, accelerated breathing, pain in the stomach, chills. In this context, it helps to lead a healthy life depending on the perception and appropriate reaction to physical differences such as hunger, satiety, thirst, weakness and fatigue, and the necessity of restroom (Albayrak Sidar, 2021, p.13). Therefore, the interoceptive sense is vital for a healthy life (Ayres, 2005, p. 42). A child who has problems with this sense might overreact when hungry, might not even be aware of being hungry, might not react at all to physical pain, or might be overreactive (Albayrak Sidar, 2020, p. 164).

The senses begin to develop while still in the womb and play the first mediating role in the baby's interaction with the environment after birth. From a developmental perspective, it is known that brain development is rapid and a significant part of it develops in the first years of life. In this process, which affects many situations such as interaction with the environment, exploring, recognizing, learning and even the psychology of the individual, the importance of supporting the senses, each of which has a separate function, emerges. Therefore, it is esential to remind that the right support given to children, especially in the period covering infancy and pre-school, is very important for the healthy functioning of the senses.

Identifying Sensory Patterns in Assessing Children's Behavior: Dunn Model in Sensory Processing

The way children interpret the information they receive from their bodies and their environment through their senses, their sensory processing, varies. Activities for the daily routine needs of each child could be adapted according to the sensory model. Therefore, sensory models should be recognized before determining the activities (Dunn, 2007).

Dunn mentions four sensory processing models for each age and mentions that the models are more predominant in sensitive individuals. It is seen that Dunn's model, which is named as "4 patterns" in the English literature, is referred to with different names in the Turkish literature. While the expression "pattern" (Kaplan, 2020; Sevgili, 2021; Özyürek, 2021) is frequently used, the expression "model" (Yardımcı-Lokmanoğlu, 2021) is also used. In this article, because the first meaning of the word "pattern" in Turkish is "model", that the model includes the meaning of defining the characteristics of people, and that the four mentioned models talk about the characteristics of people, the concept of "model" was preferred. Dunn's

sensory processing model is presented in Figure 1.

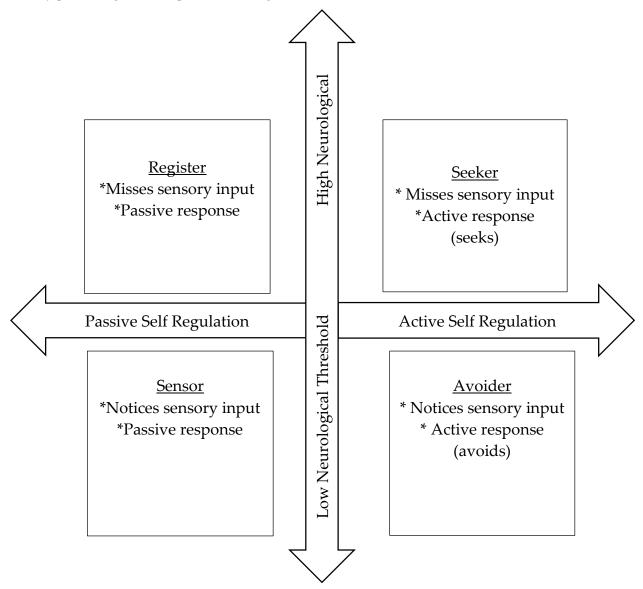


Figure 1. Overview of Dunn's Sensory Processing Model (Butera et al., 2020)

Notes. The figure was created by Butera et al. (2020) by modifying Dunn's sensory processing framework (Dunn, 2014). The examples given in the figure are not taken because the subject of the referenced article is children with Autism Spectrum Disorder.

As seen in Figure 1, Dunn put forward four basic models in the sensory processing process. The intersection of high threshold and passive self-regulation strategy results in the low registration model, the intersection of high threshold and active self-regulation strategy results in the sensory seeking model, the intersection of low threshold and passive self-regulation strategy results in the sensory sensitivity model, and the intersection of low threshold and active self-regulation strategy results in the sensory avoidance model (Dunn, 1997; Dunn & Daniels, 2002; Dunn, 2007).

Neurological threshold is the amount of required stimuli for the nervous system to recognize or respond to stimuli, whereas behavioral responses are the responses of children according to this threshold. The limit points of the neurological threshold are habituation and sensitization (Dunn, 1997). Habituation refers to recognizing familiar stimuli that do not require additional attention. Children might not be able to react to every available stimulus, so familiarization is an important requirement. Hence, children could focus their attention on their tasks and eliminate distracting stimuli (Dunn, 2000). Sensitization is the increase in children's awareness of what is happening around them. Therefore, children could be more

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attentive when playing or learning outside (Dunn, 1997).

There are many behavioral responses to sensory inputs that point to the self-regulation strategies for children. One end of the stick includes passive self-regulation strategies, which refers to children who are sensitive to sensory events and allow many events to occur in their environment, while the other end of the stick includes active self-regulation strategies, which refer to children who control their sensory experiences (Dunn & Daniels, 2002). For example, children with a passive self-regulation strategy would continue to sit next to other children in a playground where all the random noises are present and disturbing. On the other hand, when the same children have an active self-regulation strategy, they might move towards a quiet place in case there is a noise that disturbs their. Children might also have different sensory models as mentioned earlier. Therefore, it is important to be able to recognize sensory models in order to provide appropriate support to children (Dunn, 2007).

Below is the definition of the four sensory models and activities, related to the models. The suggestions were inspired by the examples in Dunn's (2007) table of supportive strategies for children's sensory models and constructed by the authors to provide routine-based positive experiences. In this context, for example, Dunn's suggestion to offer toys with different textures while playing for a child with a low register model was expanded by the authors to draw the child's attention to different textured bags, fabrics, bags, carpets, ropes, ropes, legumes at home and exemplified with a game example. The examples, provided by the authors, could be adapted by professionals working with children, taking into account the sensory model, developmental level, readiness, opportunities and possibilities of the family, socioeconomic and cultural levels of the family.

Children with a low registration pattern have a high sensory threshold and have difficulty noticing many things that others notice quickly. They might be unresponsive to what others react to and what is happening around them. Due to the passive self-regulation strategy, they do not seek input and are unable to follow the situations around them. In this context, if the adults talks to the children and makes contact with then, they might succeed in attracting their attention (Dunn, 1997; Dunn, 2007; Dunn, 2014).

Supportive suggestions: Draw attention to different textures, smells and sounds in the environment. Different textured materials found at home such as bags, fabrics, bags, carpets, ropes, ropes, legumes, etc. could be used during play. Materials with different textures could be thrown into a box and selected by hand to play conversational games about what that texture is and what other similar textures are around. While playing the game, the child's interest could be attracted to the game with expressions such as "I wonder which object I grabbed/now it's your turn". Similarly, during daily routines, the object could be covered, and the child's attention could be attracted, and the object could be talked about by covering the object and making it a game such as "Oh, the wax has disappeared, I wonder where it is, here it is, what kind of texture/smell it has". When dressing, textured, bright and contrasting colored clothes could be chosen. Food could be served in different consistencies and in contrasting colors with the plate, and food could be shaped like trees, sun, flowers, houses, etc. with the child. Soaps of different textures could be used to wash hands and towels of different textures could be used to dry hands, and a game of drawing shapes on a mirror with soap could be played. While reading a story or talking about a visual, melody could be added to the conversation with different voice intonations, various facial expressions and gestures could be used, activities such as making sounds together, playing music in the background and dancing together could be done. Skin-to-skin contact with the child when waking up. Harmless scented lotionscould be applied to the child's body and toys. Play games to move objects of a certain weight. For example, vegetables with different odors could be placed on a plate and played across without dropping them, then the smell of the vegetables could be discussed. Once safety is ensured, the child could be allowed to pick up toys placed in places that are difficult for the child to reach.

Children with a sensory seeking pattern derive pleasure from the sensations they receive in their daily routine. They have high neurological thresholds and do not easily recognize stimuli. They react to stimuli in their environment through their curiosity to create sensory experiences for themselves, that is, through their use of active self-regulation strategies. Children's interests could be easily identified by

observing their behavior. For example, children who develop an interest in tactile sensation exhibit the behavior of touching everything around them. Children, who are interested in auditory stimuli, exhibit continuous sound-making behavior throughout the day, either through their mouths or other objects (Dunn, 1997; Dunn, 2007; Dunn, 2014).

Supportive suggestions: Food of different consistency and color, clothes and objects of various textures could be presented. The child could be involved in the process by allowing the child to make choices. The child could be encouraged to wear different accessories such as brightly colored headbands and belts while dressing. Live music could be played in the background, different legumes, beads could be thrown into a box and maracas could be made, etc. The child could dance together to the accompaniment of homemade or ready-made musical instruments. Feelings related to the senses could be shared with the child and a conversation could be held about what the child feels. Scented products could be used to clean the child's body and toys, massage with these products, and body awareness could be achieved by talking about the massaged area. With the help of a cardboard and papers, a heavy texture book could be created, in which different textured objects such as stones, leaves, sugar cubes, soda caps, etc. could be placed. This book could be placed on the child's lap and attention could be drawn to the textures in it. A mirror could be placed on the floor so that the child could see himself/herself and draw attention to himself/herself.

Children with a sensory avoidance pattern tend to withdraw internally quickly from situations. Their nervous system might have difficulty processing too many stimuli and might not be able to handle too much information. Therefore, too much information given to the child might cause the child to overreact. Children in this model are at a low sensory threshold as they are simple to recognize stimuli and use an active self-regulation strategy to control inputs. Children with a sensory avoidance pattern receive limited sensory input, in contrast to a child who seeks sensory stimuli. They could be quite finicky about feeding. They might be disturbed by loud noises and do not like to be in crowded places as they do not like to be touched. These withdrawal behaviors exhibited by children are strategies they use to cope with excessive input (Dunn, 1997; Dunn, 2007; Dunn, 2014).

Supportive suggestions: Cotton towels might be preferred for drying. Clothes could be warmed and placed in one place as clutter could be disturbing. During play, attention could be paid to sitting upright or staying in the chosen position. The position of an upright animal such as a meerkat could be shown to the child to make it fun to stay still. Food could be limited rather than varied. Calm and quiet environments could be preferred during games and activities. Routines such as wearing pyjamas for sleep, saying good night to everyone, reading and telling stories in a calm voice, etc. could be determined and implemented regularly. Heavy blankets and wool quilts could be used while performing a task during daily routines. This material could be made by placing objects that would not hurt the child (e.g. beads, shells, etc.) inside the quilt. Objects that the child wants to reach could be placed within easy reach. During games and routines, attention could be directed not to present objects, lights, sounds, smells and foods in several different colors. Daily routines could be discussed with the child before they are changed too much and before the time comes, and pictures could be drawn about the routines. In this context, for example, a picture of the shower could be drawn before bathing, the child could be allowed to take the toy of his/her choice into the bathroom and play with it in the water, and in this way the child could be prepared for the process.

Children with the sensory sensitivity model are internally oriented to be sensitive and reactive to situations. Since they have a low sensory threshold, their perception of many situations is open, so they are children with high environmental awareness. They tend to use passive self-regulation strategies when reacting to events. Children in this model might exhibit behaviors such as aggressive attitudes and quick anger. In this context, the act of moving an object from one place to another could be difficult for children with sensitivity to movement, because these children could be reactive when they hit another object while moving the object. At the same time, since they are very mobile, they might have difficulty with actions such as holding, pulling and lifting an object. In the case of sensitivity to sound, children in this model might exhibit behaviors such as asking others to be quiet and plugging their ears (Dunn, 1997; Dunn, 2007; Dunn, 2014).

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Supportive suggestions: When dressing, choose products made from natural materials and try dressing in different positions, such as sitting, standing, lying down, with songs to make the process fun. Foods that the child likes, at the desired temperature and consistency, and in similar colors could be offered at the same time. Objects and toys could be placed within easy reach of the child. Active games such as jumping, jumping, running, wrestling could be played by creating a safe area where the child would not hit himself/herself on a floor with a texture that the child prefers, where a large number of visual objects, sounds and textures are not presented. Walk in nature stepping on soil and grass activities could be done. Products such as earplugs, headphones, etc. could be used in environments with sound sensitivity. In order to familiarize children with sound, they could play games with objects such as vacuum cleaners, aspirators, hair dryers, etc. that resemble the audible devices at home. In this context, for example, a hair dryer could be a microphone and a song could be sung together. Without directly exposing the child to the sound, the child could be included in the game by slowly turning the appliances on and off. Care could be taken not to expose the child to places with intense odors such as eating and drinking places, perfume shops, etc. Smells, textures, and tastes, which attract the child, coul be more likely preferred. Try not to disrupt the order of daily routines. Create a safe narrow space and play games of moving and carrying heavy objects. For example, a pushing race could be organized by putting toys, books, etc. in the laundry basket, games such as pulling the materials placed on the blanket forward without dropping them, or a goal scoring game using a heavy ball such as a basketball or volleyball ball into a goal made of pillows. Smooth music, odorless sleep products, a light-free environment, heavy blankets and quilts could be used when doing a task during the day.

For the most part, children respond moderately to sensory inputs in daily life. In this context, activities for the four sensory models mentioned above could increase children's participation in these activities. In addition, these activity suggestions offer solutions to create an intervention plan by making necessary adaptations in daily life routines in cases where children's reactions to inputs are excessive (Dunn, 2007). In this context, a study in the literature (Alizadeh et al., 2024) concluded that teaching about sensory processing models for parents of preschool children on the basis of Dunn model was effective in reducing children's anxiety problems. This result might enable children to be more successful by increasing their participation in routines. On the other hand, research on sensory models reveals that sensory sensitivity is more common. In this context, Vasak et al. (2015) conducted a study with a sample of typically developing infants and toddlers and reported that participants with the sensory sensitivity model were in the majority, but the presence of other models was also noted. Therefore, studies reveal the significance of emphasizing and supporting sensory models.

Conclusion

Studies on sensory systems are valuable not only because they provide scientific outputs that affect child development, but also because they affect children's families, friends and society as a whole. The senses are a kind of food for the brain, providing the person with the necessary data to control his/her mind and body. Therefore, when the senses are not well organized in the brain, the process of making sense of information is interrupted (Ayres, 2005, p. 6). When a child's nervous system is unable to respond meaningfully to the sensory inputs it receives, the behaviors exhibited by the child could be evaluated as if the child has a behavioral problem. To exemplify, children, who tend hugging, movement, and body activation when they could not find them, they might exhibit some disapproved behaviors. Behavior could be the result of a combination of events or the child's way of reflecting his/her reaction based on attention seeking or negative sensory experiences. Although it is not simple to understand whether the source of a behavior is behavioral or sensory processing problems, it is important to observe the child's behaviors, to identify possible triggers, and to handle each event on a case-by-case basis (North Shore Pediatric Therapy, 2024). Indeed, some studies show that sensory processing problems are associated with behavioral outcomes (Baker et al., 2007). Due to this relationship, Critz et al. (2015) also emphasized the importance of conducting developmental assessment and addressing the case with multiple disciplines. In another study (Nesayan et al., 2018), researchers who found a relationship between children's sensory processing models and behavioral patterns emphasized that this relationship should be taken into account in the therapy

process.

Dunn's sensory processing model, which is the basis of this article, acts as a guide to support children's sensory development and sensory regulation. However, it would not be wrong to state that sometimes the opinion and support of a single expert might be insufficient for the sensory problems experienced by children. In this context, one of the applications that is especially popular nowadays regarding some of the apparent problems in sensory development, which was studied in the study, is 'sensory integration' therapy applied by experts trained in this field. Sensory integration briefly refers to the regulation of sensory inputs received from the individual's body and the environment (Ayres, 2005, p. 5; Bumin, 2019, p. 151). Its aim is to reduce the problem in the problem area and to ensure learning by providing the necessary amount of sensory stimuli to the individual and differentiating the sensory stimulus perception of the nervous system (Motavalli-Mukaddes, 2014, p. 178).

Considering the importance of a transdisciplinary approach in working with children, the view that experts from different disciplines could maximize the efficiency of the process with teamwork should be adopted. Child developers, who undertake very important tasks wherever there are children, work in the first, second and third level health services of the Ministry of Health such as healthy life centers, health directorates, hospitals and in many different institutions. In this context, child developers work for the best interest of children and their families in the 0-18 age group, who are at every socioeconomic and sociocultural level of the society and who show normal development, have special needs, need protection, are sick at risk, disadvantaged in terms of environmental and sensory stimuli, and apply preventive and intervention approaches. Hence, this study, which focuses on knowing and supporting sensory development, playing an important role in the child's developmental process, is discussed from the perspective of child development. The study also scrutinizes to emphasize the importance of child developers and raise awareness about the functioning of sensory systems, recognizing children's sensory models and the support that could be provided for this. In order to raise healthier generations, every country, relevant institutions and organizations, and every professional group working with children should emphasize the importance of sensory development, which is the basis of learning, should carry out the necessary awareness-raising and support activities, and everyone should be ensured to do their part by including parents in the process.

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References

Akagündüz, D., & Aksoy, A. B. (2020). Duyu eğitimi programı'nın korunma ve bakım altındaki bebeklerin motor gelişimine etkisinin

incelenmesi [Investigation of the effect of sensory training program on motor development of infants under protection and care]. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 16 (1), 133-144. <u>https://doi.org/10.17860/mersinefd.623248</u>

- Aktümsek, A. (2009). Anatomi ve fizyoloji. İnsan biyolojisi [Anatomy and physiology. Human biology]. (4. bs.). Nobel Akademik Yayıncılık.
- Albayrak Sidar, E. (2020). Duyu'lmak istiyorum [I want to be heard]. (9. bs.). Sola Unitas.
- Alisinanoğlu, F., & Bartan, S. (2022). Okul öncesi dönemine ilişkin Türkiye'de yapılan duyu eğitimi ile ilgili araştırmaların incelenmesi [Examination of research on sensory education in Turkey related to preschool period]. *Journal of Sustainable Educational Studies* (*JSES*), 3 (2), 111-123.
- Alizadeh, S., Mazaheri, M. A., & SayedMousavi, P. S. (2024). Effectiveness of the Dunn's model of sensory processing styles training program to mothers of preschool children on reducing their children's symptoms anxiety disorders. *Journal of Family Research*, 19 (4), 671-687). <u>https://doi.org/10.48308/JFR.19.4.671</u>
- Ayres, A. J. (2005). Sensory integration and the child. Western Psychological Services.
- Baker, A. E., Şeridi, A., Angley, M. T., & Young, R. L. (2007). The Relationship between sensory processing patterns and behavioural responsiveness in autistic disorder: A pilot study. *Journal of Autism and Developmental Disorders*, 38 (5), 867-875. <u>https://doi:10.1007/s10803-007-0459-0</u>
- Başcan, B. (2021). 3-10 yaş grubunda atipik otizm ve dikkat eksikliği hiperaktivite bozukluğu tanısı almış çocuklarda duyu bütünleme eğitiminin incelenmesi [Investigation of sensory integration training in children diagnosed with atypical autism and attention deficit hyperactivity disorder in 3-10 age group]. [Unpublished master thesis]. İstanbul Arel Üniversitesi.
- Beşir, H. (2020). Bebek kütüphanesinde verilen "duyusal deneyimler" eğitim programının bebeklerin gelişim alanlarına ve duyu gelişimine etkisinin incelenmesi [Investigation of the effect of the "sensory experiences" training program given in the baby library on the developmental areas and sensory development of infants]. [Unpublished master thesis]. Karabük Üniversitesi.
- Bumin, G. (2019). Ergoterapi: Teoriler, modeller ve uygulama yaklaşımları [Occupational therapy: Theories, models and practice approaches]. G. Bumin, B.S. Akel & Ç. Öksüz (Ed.). *Duyu bütünleme modeli* [Sensory integration model]. (pp. 151-163). Hipokrat.
- Butera, C., Ring, P., Sideris, J., Jayashankar, A., Kilroy, E., Harrison, L., Cermak, S., & Aziz-Zadeh, L. (2020). Impact of sensory processing on school performance outcomes in high functioning individuals with autism spectrum disorder. *Mind, Brain, and Education*, 14 (3), 243-254. <u>https://doi:10.1111/mbe.12242</u>
- Cascio, C., Moore, D., & McGlone, F. (2019). Social touch and human development. *Developmental Cognitive Neuroscience*, 35 (2), 5-11. https://doi:10.1016/j.dcn.2018.04.009
- Costa-López, B., Ferrer-Cascales, R., Ruiz-Robredillo, N., Albaladejo-Blázquez, N., & Baryla-Matejczuk, M. (2021). Relationship between sensory processing and quality of life: A systematic review. *Journal of Clinical Medicine*, 10 (17), 3961. <u>https://doi.org/10.3390/jcm10173961</u>
- Critz, C., Blake, K., & Nogueira, N. (2015). Sensory processing challenges in children. *The Journal for Nurse Practitioners*, 11 (7), 710-716. <u>https://doi.org/10.1016/j.nurpra.2015.04.016</u>
- Çetin-Sultanoğlu, S. & Aral, N. (2015). Bebeklik ve ilk çocukluk döneminde (0-36 ay) gelişim. Duyuların gelişimi ve desteklenmesi [Development in infancy and early childhood (0-36 months). Development and support of the senses]. M. Yıldız Bıçakçı (Ed.), Duyuların gelişimi [Development of the senses]. (pp. 205-223). Eğiten Kitap.
- Duman, B. (2015). Neden beyin temelli öğrenme [Why brain-based learning]. (4. bs.). Pegem.
- Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and families: A conceptual model. Infants & Young Children, 9 (4), 23–35. <u>https://doi:10.1097/00001163-199704000-00005</u>
- Dunn, W. (2000). Habit: What's the brain got to do with it? The Occupational Therapy Journal of Research, 20 (1), 6S-20S. https://doi:10.1177/153944920002005102
- Dunn, W. (2007). Supporting children to participate successfully in everyday life by using sensory processing knowledge. *Infants & Young Children*, 20 (2), 84-101. https://doi:10.1097/01.IYC.0000264477.05076.5d
- Dunn, W. (2014). Sensory profile 2: User's manual. Pearson.
- Dunn, W., & Daniels, D.B. (2002). Initial development of the infant/toddler sensory profile. *Journal of Early Intervention*, 25 (1), 27–41. https://doi:10.1177/105381510202500104
- Kahle, W., & Frotscher, M. (2009). Nöroanatomi [Neuroanatomy]. (6. bs.). M. Onar, H. Y. Türker, O. Bayrak, H. B. Turgut, S. Önderoğlu, M. Erbil & E. Ulupınar, Tr.). Ekspress.
- Kaplan, B. (2020). Uyku problemi olan 12-36 aylık çocuklarda vestibülo-oküler ve duyusal işlemleme ile ilgili davranışsal yanıtların incelenmesi [Investigation of behavioral responses related to vestibulo-ocular and sensory processing in 12–36-month-old children with sleep problems]. [Unpublished master thesis]. Hacettepe Üniversitesi.

- Koyuncuoğlu, B. (2017). Anasınıfına devam eden dört beş yaş çocukların yaratıcı düşünme becerilerine duyu eğitim programının etkililiğinin incelenmesi [Investigation of the effectiveness of sensory education program on creative thinking skills of four and five year old children attending kindergarten]. [Unpublished master thesis]. Hacettepe Üniversitesi.
- Little, L. M., Dean, E., Tomchek, S., & Dunn, W. (2018). Sensory processing patterns in autism, attention deficit hyperactivity disorder, and typical development. *Phys Occup Ther Pediatr*, 38 (3), 243-254. <u>https://doi:10.1080/01942638.2017.1390809</u>
- Motavalli-Mukaddes, N. (2014). *Otizm spektrum bozuklukları tanı ve takip* [Autism spectrum disorders diagnosis and follow-up]. Nobel Tıp Kitabevleri.
- Nesayan, A., Gondomani, R. A., Motavalli, G., & Dunn, W. (2018). The relationship between sensory processing patterns and behavioral patterns in children. *Journal of Occupational Therapy, Schools, & Early Intervention, 11* (2), 124-132. <u>https://doi.org/10.1080/19411243.2018.1432447</u>
- North Shore Pediatric Therapy. (2024, February 1). Biting, hitting and pushing: Bad behavior or sensory processing disorders? https://www.nspt4kids.com/specialties-and-services/occupational-therapy/biting-hitting-and-pushing-bad-behavior-or-spd
- Özata, S.C. (2015). Okul öncesinde oyun temelli duyu eğitimi [Play-based sensory education in preschool]. Nobel Akademik Yayıncılık.
- Özyürek, M. (2021). Farklı duyusal profillere sahip sağlıklı bireylerde vücut farkındalığı ile postur ve dikkat farkındalığı arasındaki ilişkinin incelenmesi [Investigating the relationship between body awareness and posture and attention awareness in healthy individuals with different sensory profiles]. [Unpublished master thesis]. Üsküdar Üniversitesi.
- Patil, O., & Kaple, M. (2023). Sensory processing differences in individuals with autism spectrum disorder: A narrative review of underlying mechanisms and sensory-based interventions. *Cureus*, 15 (10), 1-7. <u>https://doi:10.7759/cureus.48020</u>
- Pérez-Fonseca, R., Burguillos-Torres, G. E., Castillo-Velásquez, V. G., Moreno-Zuleta, N., Fonseca-Angulo, R. I., Blumtritt, C., & García-Jiménez, R. (2019). Sensory profile in children with autism disorder and children with typical development. *Revista Mexicana de Neurociencia*, 20 (5), 229-236. <u>https://doi.org/10.24875/rmn.m19000019</u>
- Polen-Akşimşek, G. (2020). Otizmi oyuna getir: Nöroplay Yöntemi [Bring autism to play: Neuroplay method]. B. Ekici ve M. Yıldız Bıçakçı (Ed.). Duyusal Gelişim ve Otizmli çocuklar [Sensory development and children with autism]. (pp. 59-63), Otizmli çocukların duyusal profilleri [Sensory profiles of children with autism]. (pp. 64-66), Duyusal oyun piyesleri [Sensory play games]. (pp. 126-150). Ekinoks.
- Raditha, C., Handryastuti, S., Pusponegoro, H. D., & Mangunatmadja, I. (2023). Positive behavioral effect of sensory integration intervention in young children with autism spectrum disorder. *Clinical Research Article*, 93 (6), 1667-1671. <u>https://doi:10.1038/s41390-022-02277-4</u>
- Santrock, J. W. (2018). Yaşam boyu gelişim: Gelişim psikolojisi [Life-span development: Developmental psychology]. (M. Arı, Tr.). Nobel Akademik Yayıncılık.
- Sevgili, S. (2021). Okul öncesi dönem çocuklarında ebeveyn tutumu ile duyusal profilin ilişkisinin incelenmesi [Investigation of the relationship between parental attitude and sensory profile in preschool children]. [Unpublished master thesis]. Hacettepe Üniversitesi.
- Unay, Ö. S., Doenyas, C., Ekici, B., Gönen, İ. & Tatlı, B. (2020). Sensory problems in Turkish children with Autism Spectrum Disorder. Journal of Child, 20 (2), 59-65. https://doi:10.26650/jchild.2020.2.773059
- Uyanık-Balat, G., Deretarla-Gül, E., & Çelebi-Öncü, E. (2005). Okul öncesi dönemde duyu eğitimi ve etkinlikler [Sensory education and activities in preschool period]. Kare.
- Vasak, M., Williamson, J., Garden, J., & Zwicker, J. G. (2015). Sensory processing and sleep in typically developing infants and toddlers. *The American Journal of Occupational Therapy*, 69 (4), 1-8. <u>https://doi.org/10.5014/ajot.2015.015891</u>
- Yardımcı-Lokmanoğlu, B. N. (2021). Prematüre bebeklerde general movements, duyusal işlemleme ve nörogelişimsel parametreler arasındaki ilişkinin incelenmesi [Investigation of the relationship between general movements, sensory processing and neurodevelopmental parameters in premature infants]. [Unpublished master thesis]. Hacettepe Üniversitesi.
- Yazıcı, E. (2013). Okuma yazma becerilerini destekleyici duyu eğitimi programının 61-66 aylık çocukların okuma yazma becerilerine etkisi [The Effect of sensory training program supporting literacy skills on 61-66 month-old children's literacy skills]. [Unpublished doctoral thesis] Gazi Üniversitesi.