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Specialized and updated training on supporting advance technologies for early childhood education and care professionals and graduates

MODULE III.6

Sensory impairments

Teacher

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I. Introduction

Sensory systems enable people to interact with the environment. This topic develops the seven sensory systems involved in the exchange of information between people and the environment: touch, hearing, taste, smell, sight, proprioception and vestibular. It also deals with the most common sensory impairments: visual impairment, hearing impairment and sensory integration disorders. The typology and cause of these disorders and the consequences they have on child development are detailed.

II. Objectives

The objectives of this thematic unit are:

- To know the seven sensory systems.
- Recognise sensory impairments.
- To observe the characteristics of sensory disturbances and their impact on child development.

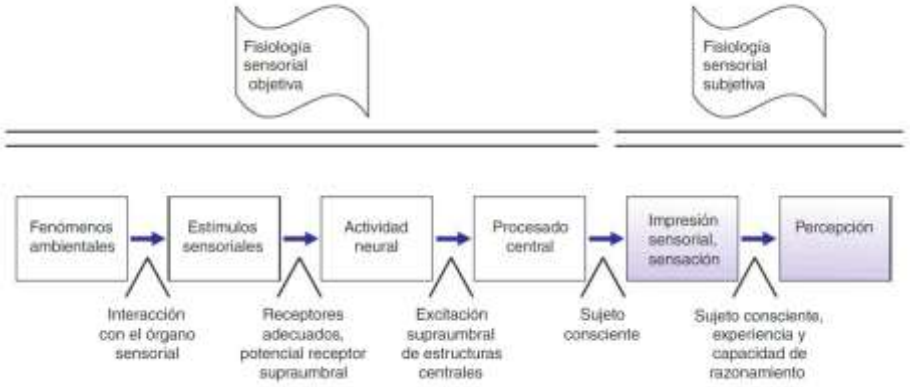
III. Content specific to the theme

3.1. Sensory systems

Sensory systems allow the interaction of the individual with the outside world, this interaction defines the person, as it influences how he/she performs activities, how he/she interacts with other individuals, and his/her state of alertness-wakefulness. Dr. Ayres in 1972, proposed that sensory information reaching the central nervous system (CNS) is processed and analysed to provide an adapted response to both the physical and social environment; to carry out this process the nervous system must coordinate a response according to the environment and previous learning.

The link of the CNS with the outside and inside occurs thanks to specialised neural structures called sensory receptors. Sensory stimuli produce in the receptors an excitation of afferent sensory fibres, which is integrated in the central sensory areas through the combination of the various synaptic circuits, which in general, this information is confronted with lived and learned experiences generating in the individual a perception of the sensory stimulus, therefore there are different levels of organisation that interact in the sensory physiology (objective and subjective) as shown in figure 1, the sensory stimulus goes through a series of objective and subjective stages until it generates a perception.

Figure 1. Levels of objective and subjective physiological organisation of sensory stimuli.



Source: Cardinali, 2007

Each stimulus has four basic dimensions (Cardinali, 2007):

- Spatiality and temporality describe the stimulus in time and space, e.g. when something touches the skin it can be located on an area of the body (spatiality) and the beginning and end of the stimulus is identified (temporality).
- Modality defines the type of sensation: visual, auditory, tactile, gustatory, olfactory, proprioceptive or vestibular. The environment is experienced through isolated elements produced by interaction with appropriate stimuli with their receptors (visual, tactile...). Within each modality in general, different qualities are distinguished, for example, the qualities of taste are bitter, salty, sweet, and sour.
- Intensity is the quantitative expression of a sensation, it is related to the stimulation of the receptor by the sensory stimulus.

3.2. Main sensory systems

There are five exteroceptive senses (vision, hearing, touch, smell and taste) that enable people to participate appropriately in their environment and two interoceptive senses (proprioceptive and vestibular). The importance of the senses is seen, for example, in a child's orientation in a static and dynamic environment, the CNS must construct and continuously update an accurate representation of our world, achieved by integrating signals from the different senses (Arshad et al., 2019).

3.2.1. Touch system

The tactile system allows us to appreciate the external sensations of cold, heat, pressure, texture, vibration, tingling, as well as the weight we are holding, the force our muscles exert, etc. Touch is extremely important for every human being, it allows us to enjoy a caress, the warm rays of the sun, the cool wind, and an endless number of pleasant sensations; it also protects us against sensations that can cause us harm or pain.

The skin, the largest organ, is prepared to discriminate the size, shape and texture of objects (Abraira, Ginty, 2013). The skin is innervated by a large number of sensory neurons: nociceptors, which perceive painful stimuli; pluriceptors, which transmit itching; thermoreceptors, which register temperature information; and low-threshold

mechanoreceptors, which perceive non-painful mechanical stimuli or touch (Abraira, Ginty, 2013; Zimmerman et al., 2014).

The person has different types of skin that have a differentiated role. Thus, the hairy skin is associated with affective touch, which evokes an emotional response, while the grafted skin found on the hands and feet is specialised in discriminatory touch, determining texture and recognising objects, providing the CNS with control of grasping, reaching and proper locomotion (Zimmerman et al., 2014).

Touch has two main functions: protection against harmful stimuli, which is why this system is closely related to people's state of alertness to protect themselves, and discrimination of tactile stimuli, which allows us to recognise the objects with which we interact.

3.2.2. Auditory system

The auditory system is the set of anatomical structures that enable the sensory perception of sounds. Auditory information reaches the CNS in the form of sound, which is the result of variations in air pressure produced by vibrations of its molecules that are transmitted in the form of waves. The human ear can pick up sounds whose frequency ranges from 20 Hz (bass) to 15,000 Hz (treble) (García-Porrero, Hurlé, 2014).

The ear (or peripheral auditory system) begins at the pinna and extends to the cochlea. Its mission is to convert mechanical vibrations into nerve impulses for processing in the brain. For its study, it is divided into three parts: the outer ear, the middle ear and the inner ear. The pinna captures the sound waves, sending them through the external auditory canal to the tympanic membrane (external ear); this membrane comes into contact with the vibration of the air molecules, which transmits the vibration to the hammer, anvil and stirrup (middle ear); the activation of the stirrup produces a liquid wave that generates an activation of the cochlea (inner ear) that converts the acoustic signals into electrical impulses capable of being interpreted by the CNS (Villamizar 2018).

3.2.3. Visual system

The visual system is the most important of the human sensory systems. It allows us to acquire a large amount of information from the outside world. That is why a large part of the cerebral cortex is involved in the analysis of visual information, it can be said that the human brain is fundamentally optical (García-Porrero, Hurlé, J, 2014).

Visual information arrives via the radiation emitted by objects, luminous radiation of varying frequency and intensity that penetrates the interior of the eyeball through the pupil. The pupil dilates or contracts depending on the light conditions through the action of the iris. The light signal then passes through the cornea, the lens and the aqueous inner chamber to reach the retina, the photosensitive part of the eye, where the ganglion, bipolar and photoreceptor cells are located. The retina is a photoreceptor tissue that covers most of the inner surface of the eye and forms the plane onto which images are projected in an inverted form. In the retina, photoreceptors (cones and rods) convert light into electrochemical energy that is transmitted to the brain via the optic nerve.

The nerve bundles from each eye meet at the optic chiasm, where part of them cross over to the opposite cerebral hemisphere. Fibres coming from the left side of both retinas (and corresponding to the right side of the visual field) project to the left hemisphere, and those

coming from the right side of both retinas (and corresponding to the left side of the visual field) project to the right hemisphere (Torrades, Pérez-Sust, 2008).

3.2.4. Olfactory and gustatory

The senses of smell and taste are similar in their ability to detect chemical signals in air or saliva. These signals are transmitted to the CNS as nerve activity, where they are interpreted as smell or taste. The sensation of smell is extremely diverse, as it can distinguish thousands of different chemical compounds. Taste, however, is more limited and can distinguish about five different modalities (Champney, 2017).

The sense of taste is very important in food; certain tastes are perceived as pleasant and play a hedonic role; others, such as bitter tastes, are perceived as unpleasant and are associated with toxic substances. Strictly speaking, taste is the set of sensations that originate in the taste receptors; however, the perception of flavours is also influenced by olfactory sensations and proprioceptive sensations originated in the mouth by the texture of food (García-Porrero, Hurlé, 2014). Taste receptors respond to a wide variety of molecular food components that give rise to five modalities: sweet, salty, bitter and umami.

The organ of taste is made up of taste buds, which are distributed throughout the lingual papillae, the mucosa of the palate and pharynx. Each taste bud contains different cells that are sensitive to the five taste modalities, at the base of the bud is linked to the afferent nerve branch that transmits the nerve impulse to the CNS.

Olfaction in humans is less important than for some animals, which have reproductive, social interaction and safety functions. Nevertheless, the olfactory system has the capacity to recognise more than 10,000 odours, and very low concentrations. Odours evoke our memories and influence mood and pleasure in eating. The olfactory system is stimulated by airborne substances called odour molecules, which are volatile substances. These substances enter the nose with the inspired air and can dissolve in the nasal mucus to reach the receptor. Most odours are a mixture of several odours that make up an odorous object which is perceived by the CNS. Thus, the CNS picks up odorous objects such as the smell of orange, chocolate, cheese...

The olfactory system is made up of the olfactory sensory organ, which is the olfactory epithelium of the nasal mucosa, the olfactory pathway and the olfactory centres. This system has three peculiarities (Champney, 2017, García-Porrero, Hurlé, 2014):

- The receptor cell is also the first neuron of the olfactory pathway.
- The information reaches the cerebral cortex directly through other structures.
- It is a system with a very low threshold of stimulation, but with a great capacity for adaptation, so that the perception of the odour stimulus lasts for a very limited time.

The olfactory system begins in the upper portion of the nasal cavity with specialised olfactory neurons within the mucosal epithelium. The dendrites of these neurons, which have specialised receptors for distinguishing different compounds, carry the nerve impulse to the olfactory bulbs on the lower surface of the frontal cortex. Neurons in the olfactory bulb project the information to the primary olfactory cortex, which has connections to the limbic system, the thalamus and the frontal cortex (Champney, 2017).

3.2.5. Proprioceptive system

The term proprioception is defined as the subconscious and conscious awareness of the spatial and mechanical state of the body, which includes joint position, total or body part position in space, movement and force exerted on objects (Ager et al., 2017).

The main receptor of proprioception is the muscle spindle which specialises in detecting changes in muscle length and speed of contraction, this structure is able to anticipate changes because it can quickly detect changes in both the speed and length of muscles (Proske, 2005). In the joints there are free nerve endings in the different joint structures that report mechanical changes of the joint structures or severe inflammatory changes of the joints (Chu, 2017). Receptors of the Golgi tendon organ are found in the ligaments and menisci, they report joint boundaries (Hillier et al., 2015). In addition to all these receptors, there are skin receptors that contribute information about joint position and movement, e.g. skin tension in the fingers, elbow and knee informs the central nervous system about their position (Ager et al., 2017).

Proprioception plays a very important role in motor planning, coordination and adaptation to make rapid changes during task execution (feedback) (Hillier et al., 2015). In addition, proprioception plays an important role in motor learning of new learning, when a child first learns a new motor skill it requires all available information (visual, proprioceptive and tactile), as the skill improves, the movements are refined and the process becomes more subconscious, at this point, proprioceptive information is used as a feedback signal to confirm correct execution of the task (Chu, 2017).

3.2.6. Vestibular system

The vestibular system encodes self-motion information by detecting head movements in space. In turn, it provides subjective information on movement, orientation and plays an important role in gaze stability, balance control and posture (Cullen, 2012).

The sensory organs of the vestibular system comprise two types of sensors: the semicircular canals, which detect angular acceleration in all three dimensions, and the two otolithic organs (saccule and utricle), which sense linear acceleration, i.e. gravity and translational movements (Cullen, 2012). The receptors of this system are activated when the cilia are flexed by the movement of endolymphatic fluid through the semicircular canals.

The most important functions of the vestibular system are balance, righting reactions, eye control, bilateral hemibody coordination and alertness control (Shayman et al., 2018).

3.3. Sensory disturbances

Within the range of sensory disorders there are a large number of dysfunctions that are linked to sensoriality, but which are very diverse and varied. Some of the common ones are detailed below.

3.3.1. Hearing impairment

According to the World Health Organisation (WHO), by 2021 more than 5% of the world's population will suffer from disabling hearing loss. Disabling hearing loss refers to a loss of more than 35 decibels (dB) in the better-hearing ear. Nearly 80% of people with this condition live in low- and middle-income countries. By 2050, nearly 2.5 billion people are expected to have some degree of hearing loss and at least 700 million will require rehabilitation.

A person with hearing impairment is someone who has an alteration in the auditory pathway, in the organ of hearing or in the brain, which will produce a loss in the quantity and quality of information from the environment via hearing that prevents them from being autonomous in daily life (Cañizares. 2015). Hearing is the main channel through which language and speech develop, so any alteration at a very early age affects linguistic and communicative development (FIAPAS, 2010).

3.3.2. Ranking

There are two types of hearing impairment: a) hypoacusis, people with hearing impairment who are able to acquire spoken language through hearing and use it functionally, although in most cases they use a hearing aid. B) deafness, profound hearing loss that prevents the acquisition of spoken language through hearing (Aguilar et al. 2008). Hearing loss can be classified based on different criteria (Cañizares. 2015., Aguilar, et al. 2008): place where the lesion occurs, degree of hearing loss or age of onset.

The site of injury:

- Conduction or transmission hearing loss: lesion produced by an alteration in the outer or middle ear, whereby the mechanical part of the ear is affected, preventing sound from adequately stimulating the cells of the organ of Corti. They correspond to pathologies of the outer and middle ear. The most frequent are serous otitis, perforation, sclerotic eardrum, otosclerosis, cholesteotoma.
- Sensorineural or perceptual deafness: damage to the cochlea (organ of Corti). Its most frequent causes can be classified according to the time of presentation as prenatal (genetic or acquired), perinatal (problems at birth) and postnatal (meningitis, otitis media, etc.).
- Mixed deafness: the pathology is both in the sound conduction pathway and in the perception pathway.
- Central deafness: loss of auditory stimulus recognition due to damage to the central auditory pathways. Some authors call it auditory agnosia.

Degree of hearing loss:

- Normal hearing: Hearing threshold (0-20 dB). The subject has no difficulties in speech perception.
- Mild or slight hearing loss (20-40 dB): the weak or distant voice is not perceived. In general, the child is considered inattentive, and its detection is very important before and during school age.
- Medium or moderate hearing loss (40-70dB): the hearing threshold is at the medium conversational level. Language delay and articulatory disturbances are very frequent.

- Severe hearing loss (70-90 dB): it is necessary to raise the intensity of the voice so that it can be perceived. The child will have very poor speech or no speech at all.
- Profound hearing loss or deafness (more than 90 dB): without appropriate rehabilitation, these children will not speak, they will only perceive very loud noises and it will almost always be more through vibrotactile than auditory hearing.
- Cophosis or anacusis. Total loss of hearing. These can be said to be exceptional losses.

Age of emergence:

- Prelocution hearing loss: the hearing loss is present at birth or appears before language acquisition (2-3 years of life) and therefore the child is unable to learn to speak in the case of severe or profound deafness.
- Post-linguistic hearing loss: hearing loss appears after the acquisition of language, progressively producing phonetic and prosodic alterations, as well as voice alterations.

3.3.3. Causes of hearing loss and deafness

According to the WHO, people can be exposed to the factors that cause hearing impairment during certain critical periods.

Prenatal period

- Genetic factors: including those that cause hereditary and non-hereditary hearing loss.
- Intrauterine infections: such as rubella and cytomegalovirus infection

Perinatal period

- Perinatal asphyxia (lack of oxygen at birth)
- Hyperbilirubinaemia (severe jaundice in the neonatal period)
- Low birth weight
- Other perinatal morbidities and their management

Childhood and adolescence

- Chronic otitis (chronic suppurative otitis media)
- Presence of fluid in the ear (chronic non-suppurative otitis media)
- Meningitis and other infections

Lifelong factors

- Cerumen impaction (earwax plug)
- Ear or head trauma
- Loud noise/sound
- Ototoxic medicines
- Ototoxic chemicals in the workplace
- Nutritional deficiency
- Viral infections and other ear conditions
- Delayed onset of hearing or progressive hearing loss due to genetic causes

3.3.4. Implications for child development

Babies and children need to be able to hear when others speak in order to develop the ability to listen and speak. When a baby is born with hearing impairment and does not receive appropriate interventions, he or she does not develop speech and language and falls behind other children with good hearing. The most important impairments are listed below (Cañizares, 2015, Aguilar et al., 2008, WHO, 2020).

Consequences for cognitive development:

- Their cognitive development is impaired due to an information deficit and a lack of use of their experiences, resulting in a lack of motivation for learning. The scarce information they receive, sometimes incomplete and even erroneous, makes it difficult for them to understand and accept rules.
- They have difficulties in planning their actions and reflecting, acting impulsively and immediately, often without calculating the consequences of their actions.
- They have great difficulty in performing tasks of abstraction or reasoning, as well as in formulating hypotheses or proposing various alternatives.
- The poverty or absence of an inner language greatly hinders the development and structuring of thought and language.

Development of sensory functions:

- Hearing loss means that a fundamental sense is missing, so vision takes on a central role.
- There is an imbalance in his spatial-temporal structuring, as his lack of hearing does not allow him to develop his orientation in space adequately.
- The loss of the sense of hearing makes it difficult to structure time and appreciate rhythm.
- Lesions of the inner ear sometimes lead to alterations of the vestibular apparatus, causing balance problems in some people with deafness.

Socio-affective development:

- The communicative processes of interaction between adult and child are poorer and their content is substantially reduced, mainly due to the lack of mastery of a common communication code for both. This implies an insufficient explanation of the facts, the reasons for things, the consequences of their actions, in short, a lack of information about the functioning and the rules that govern our society and the values on which it is based.
- The characteristics of tone, intensity and rhythm of language allow us to distinguish communicative situations of affection, tenderness, anger, etc. These emotions are difficult for the deaf person to perceive, given that their auditory channel is severely impaired, limiting their understanding of these situations to visual perceptions, which sometimes lead to errors.
- The lack of information and the lack of mastery of the immediate environment result in deaf pupils being distrustful, self-centred, touchy and sometimes impulsive.
- Deaf pupils often have difficulty in accepting frustration.

3.3.5. Visual impairment

Visual impairment is the total or partial impairment of sight. It is measured by various parameters, such as near and distance reading ability, visual field or acuity. Visual impairment or blindness is characterised by a total limitation or severe impairment of visual function. This severe loss of function affects people's autonomy, e.g. in moving around, activities of daily living, or access to information. On the other hand, it restricts the person's access to and participation in his or her different living environments: education, work and leisure.

According to the WHO there are 45 million blind people in 2020, of which 1.4 million are blind children. The prevalence of childhood blindness is higher in developing countries due to (Gilbert, Awan, 2003):

- There is an increased prevalence of conditions that cause blindness, e.g. vitamin A deficiency, harmful traditional ophthalmic treatments.
- Inadequate preventive measures for pathologies affecting vision such as measles, congenital rubella or ophthalmia neonatorum.
- There is a lack of facilities and qualified staff to handle conditions requiring surgery.

In middle-income countries, the pattern of causes is mixed, with ROP emerging as an important cause in Latin America and some Eastern European countries. Currently unavoidable causes (developed countries) include hereditary retinal dystrophies, central nervous system disorders and congenital anomalies.

There are different degrees of vision in visually impaired people, marked by optical pathologies and other possible sight problems derived from other anomalies, such as cerebral or muscular. There are two types of blindness:

- Total blindness: Blind or partially sighted people are those who see nothing at all or have only a slight perception of light (they may be able to distinguish between light and dark, but not the shape of objects).
- Partial blindness: people with visual impairment who, with the best possible correction, could see, or distinguish, some objects at very close range. Under the best conditions, some of them can read print at large size and clarity, but usually more slowly, with considerable effort and with the use of special aids.

3.3.6. Causes of visual impairment

According to WHO (2000) of the 1.4 million blind children in the world, it is estimated that 25% are blind due to retinal diseases, 20% due to corneal pathology, 13% due to cataracts, 6% due to glaucoma and 17% due to abnormalities affecting the whole globe. The following classification emphasises the most important causes of visual impairment (Gilbert, C., Foster, A. 2001):

- Corneal disorders: responsible for less than 2% of blindness in children, caused by vitamin A deficiency often precipitated by measles or gastroenteritis in children aged 6 months to 4 years.
- Cataracts and glaucoma: congenitally acquired rubella is a potential cause of childhood cataracts. The increase in this pathology is due to inadequate treatment of adult rubella together with an ineffective childhood immunisation strategy leading to an increase in congenital rubella, which can lead to cataracts.

- Successful treatment of cataracts and glaucoma requires a series of actions such as: training of health personnel caring for newborns; mechanisms to ensure that children with cataracts and glaucoma are seen by specialists; training of ophthalmologists in the assessment, surgery and long-term treatment of these children.
- Retinopathy of prematurity: it is vitally important that infant screening, detection and treatment programmes are established in all units for premature infants weighing less than 1,500g.

3.3.7. Implications for child development

There is a wide variety of limitations that can be generated by visual impairment, according to Pérez (2015) the most important of which are:

- Visual difficulties reduce the globalising aspect of vision. Perception of objects occurs in an analytical way, resulting in a slower pace of learning.
- There are difficulties in imitating behaviours, gestures and games observed visually, so he will always need personalised attention to help him understand what is going on around him, so that he is able to assimilate and reproduce it.
- His self-image may be altered as a result of the frustrations he receives when he realises that he does not react like others.
- Greater fatigue when carrying out their activities due to the greater effort they have to make when faced with any visual task.
- Exaggerated hyperactivity, if the child has not been taught, from an early age, to fix and maintain his or her attention on games and toys in his or her usual environment or on the activities we carry out with him or her.

3.3.8. Sensory integration disorders

Each child has some sensory peculiarities, these peculiarities are not of great importance, as adequate sensory processing is generated, the problem lies when the child manifests a problem in their occupation (activities of daily living, school and leisure) caused by inadequate sensory processing.

Dr Ayres proposed patterns of sensory integration dysfunction based on the results of the assessment of children with learning difficulties, and these findings were corroborated by a large number of subsequent studies (Lane et al., 2019; Mailloux et al., 2011). These patterns include:

- Sensory reactivity difficulty: adequate sensory reactivity is related to proper attention, alertness and emotion regulation (Lane et al., 2019). Sensory reactivity difficulty comprises inappropriate responses, either hyper-reactive or hypo-reactive, to everyday sensory stimulation to which most people readily adapt. It is a problem that occurs in approximately 5% of the normotypical population and in 40-80% of children with developmental disabilities. This disorder interferes with participation in daily activities such as eating, showering, toileting and socialising. There are different types of sensory reactivity difficulties: hyper-reactivity (or sensory avoidance) is characterised by an exaggerated or negative response to typical sensory experiences in everyday life; hypo-reactivity (or under-registration) is a delayed or decreased response to everyday sensory events; and sensory craving (or sensory seeking) is an insatiable drive for sensory experiences.
- Sensory discrimination: Sensory discrimination is the processing of information from one or more sensory channels that enables an individual to know body

position, relative distance from other people, details and items on the body, and features of the environment quickly and accurately (Lane et al., 2016). Impaired sensory discrimination is the result of: slow and inaccurate processing of one or more types of sensory information; insufficient response to sensations; inadequate formation of perceptions; and impaired sensory associations (Lane et al., 2016). Difficulties have been reported in different sensory systems: 1) At the tactile level, there are difficulties in differentiating dangerous stimuli, identifying objects, recognising drawings on the skin, identifying where they have been touched (all these processes without vision); in addition, an excessive dependence on vision is observed when performing fine motor tasks. 2) At the proprioceptive level, there are difficulties in graduating pressure when grasping objects, difficulty in maintaining an appropriate posture and imitating it, lack of fluidity in movements, individuals tire easily when performing movements. 3) At the vestibular level, difficulty in maintaining balance, poor head-eye and eye-hand coordination, confusion between right and left and individuals fall easily.

- Dyspraxia: Praxia is the ability to conceptualise, plan and execute competent or specialised tasks (Lane et al., 2016). Dyspraxia is the sensory processing disorder for programming actions, in environments with a diversity of possibilities (Mailloux et al., 2011); one or more components of praxis may be impaired. Individuals with dyspraxia are observed to have: poor motor skills, slowness in the execution of movements, difficulty in playing (they do not seem to know what to do, they always do the same thing), alterations at the emotional level and in participation.

Summary

The sensory systems allow the interaction of the individual with the outside world, thanks to the five exteroceptive senses (vision, hearing, touch, smell and taste) that allow people to participate appropriately in their environment and two interoceptive senses (proprioceptive and vestibular). The main sensory impairments are hearing impairment, visual impairment and sensory integration impairment.

A hearing-impaired person is a person who has an impairment in the auditory pathway, in the organ of hearing or in the brain, which will lead to a loss in the quantity and quality of information from the environment via the auditory pathway. The causes of hearing impairment can occur throughout life. Visual impairment consists of a total or partial loss of sight. It can be due to causes such as: corneal disorders, cataracts and glaucoma and retinopathy of prematurity. Sensory impairment occurs when a child manifests a problem in their occupation (activities of daily living, school and leisure) caused by inadequate sensory processing; there are three types of impairment: impaired sensory reactivity, dyspraxia and impaired discrimination.

Glossary

Sensory systems: allow the interaction of the individual with the outside world.

Touch: allows us to appreciate the external sensations of cold, heat, pressure, texture, vibration, tingling, as well as the weight we are holding, the force our muscles exert, etc.

Hearing: set of anatomical structures that enable the sensory perception of sounds.

Vision: perception of physical realities through sight.

Taste: set of sensations originating in the taste receptors.

Smell: bodily sense that allows us to perceive and distinguish odours.

Proprioception: subconscious and conscious awareness of the spatial and mechanical state of the body.

Vestibular: reports one's own movement by detecting head movements in space.

Hearing loss: people with hearing impairment who are able to acquire spoken language through hearing and use it in a functional way.

Deafness: profound hearing loss that prevents the acquisition of spoken language through hearing.

Total blindness: people who see nothing at all or have only a slight perception of light.

Partial blindness: people who, with the best possible correction, could see, or distinguish, some objects at a very short distance.

Sensory integration impairment: a child manifests a problem in his or her occupation (activities of daily living, school and leisure) caused by inadequate sensory processing.

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