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## **Sensory development of a child with special needs: resources and perspectives**

**Abstract.** Sensory processes constitute the initial stage and basis of cognition, is the ascent of the mental development of children with special needs. At the level of sensory development, the transition from sensory to rational cognition, from perception to thinking is prepared, the basis of further intellectual and practical activity is formed. The article focuses on the use of opportunities for sensory and intellectual development of the child, aimed at the formation of oral speech, perception and understanding of its content. The expediency and effectiveness of improving articulatory motility, development of visual, auditory, tactile perception of children with special needs with the purpose of correction of sensory and speech disorders are revealed. Hearing as a functional system in the education of children with special needs is aimed at developing their auditory perception and memory. Vision carries the load of both classical function and specific, which provides perception, recognition of phonemes implementers (articulatory images) in the speech stream. Tactile sensations in combination with visual and motor stimulate the cognitive sphere of the child, assimilate and enrich its vocabulary. The sensory and intellectual development of the child while mastering speech contributes to her/his personal development makes it possible to harmonize relations in the social environment.

**Keywords:** *child with special needs, sensory development, sensory processes*

Perception and understanding of speech is a complex multidisciplinary activity of the individual, which teaches: the perception of aggregate sensory stimuli and a set of intellectual actions that in their harmonious combination provide communication needs, understanding of information. **Sensory perception** in the context of the education and upbringing of children with special needs includes auditory perception of sounds, visual perception of articulation images of phonemes and verbal material (words, phrases, texts), as well as tactile perception of objects, which enables activation of knowledge of the environment, its subject world, content speech.

Another component of perception and understanding of speech is **intellectual activity**, without which it would be inaccessible to the child with

special needs interpretation of sensory and speech signals, understanding of the content of speech, the formation of internal speech. In other circumstances, her/his full-fledged speech activity would be problematic.

**Development of articulation motility.** When forming, correcting the sound, ensuring the development of internal speech, the acquisition of a child with sensory and speech disorders with articulatory motility becomes of special significance. Articulation motility, motor feelings contribute to the absorption of speech, its memorization and translate into the inner plan, which positively affects the understanding of speech, the formation of communicative abilities of the child. The study of speech and motor activity of children, which, in particular, have general underdevelopment of speech, shows that inferior anatomical and physiological conditions of formation, the limited motor component of speech cause not only an abnormal development of the sound side, but in some cases lead to a deeper systemic disruption of all components of speech (O. Luria, L. Chistovich, etc.) [Luria, 1963, <http://bookshare.net/index.php?id1=4&category=med&author=chistovich-la&book=1976>].

The lack of formation of the motor component of speech negatively affects the functional capabilities of children in phonetic and phonemic hearing, the rate of response to speech, the understanding of its content and the choice of response in the reception of speech, literacy in the case when the motor component is unbalanced in its implementation in relation to auditory, which causes difficulties in studying at school.

At the same time, the visual perception of movements of the articulation apparatus allows you to develop attention of the child, to specify the sound, to isolate the articulation implementers of the phonemes that are available to him, to automate the motor component of speech. Wakita Masumi in her article "Broca's Area Processes the Hierarchical Organization of Observed Action" [<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3894456/>], shows that a relatively long training of the speech-analyser, associated with the functional development of the Brock area, provides a hierarchy of actions projected onto the "sensitivity" the syntax, that is, from the functional state of the articulation apparatus depends on the success of not only mastering the sound and vocabulary, but also the mastery of syntactic laws.

The development of motorized images of phonemes, overcoming the motor difficulties of sound, the maturation of the articulation possibilities of the implementation of these sounds determines the inclusion of their child in their phonological system (V. Beltiukov).

The development of articulatory motility is an important part of corrective measures in working with children with sensory and speech disorders, which can

be implemented from an early age. A positive result can be achieved by using special exercises, for example, on: repeating the same direct composition based on an icon that sends images of consonant and loud. Icons can be represented in the form of arrays, rhythms, which children call a voice of different volume, delayed reproduction of perceived speech, say conjugated (simultaneously) with the speaker, imitating its articulation, and then independently at a slower and faster pace. Such exercises allow the child to overcome articulation problems, to achieve a higher level of sound. When a child with special needs acquires clear articulation, at least a significant number of sounds, there is acceleration in the mastery of other sounds, the introduction of them into speech. In addition, the articulation movement causes the generation of counter activity of the child, which allows it to timely engage in speech perception, in the intellectual process of understanding the content, provides synchronization of perception, analysis, synthesis and understanding. Articulatory motor skills, motor feelings provide the child with the activation of perception, memory, assimilation of external speech and its transfer to the internal.

**Development of auditory perception.** Hearings in correctional pedagogy should be regarded as a holistic system of education, which includes perception, recognition, identification of sounds (known sounds, sound complexes or new ones), their place in the word, the availability of auditory perception, etc. It is established that during sensory and severe speech disorders there is observed a slowdown in the recognition of sounds, speech. For example, in hearing a vocal phoneme, a child with hearing impairment can spend 25 or more seconds if her/his hearing was not yet subject to training or this exercise was not sufficiently methodically grounded (while the person who is hearing is spending 7-11 m/s). Important in the interpretation of this phenomenon is an understanding that the sound, which initially sounded for one moment, during these 25 seconds does not sound in the memory of the child remain only his traces. These tracks allow an analysis of sound by the child to be lengthened in time, and hence the formation of an acoustic image in her memory.

Observing the process of holding a sound signal in the auditory memory and its "processing" up to the reproduction of a child with violations of the auditory function indicates the significant efforts that she/he makes in her/his recognition: concentrated, point-to-point, eyes, closed eyes, face muscles, immutability, rigidity poses. These observations confirm the presence of complicated intellectual work performed by a person with a hearing impairment.

This example shows that in the formation of acoustic images of phonemes, other speech material (words, phrases) in the auditory system of a particular child, it is necessary to predict the time for her/him to recognize the signals, to remember

their acoustic images. If the length of time required by a particular child to analyse the sound image of the phoneme, the words will be smaller, then the so-called "masking" of some sounds by others, which complicates recognition of phonemes, their combinations in words, causes difficulties in the development or correction of phonetic and phonemic hearing, leads to a decrease in the productivity of the educational process, unreasonable physical and intellectual efforts. Further reduction of the processing time of the speech signal can be ensured by the development of, first of all, clear acoustic-articulatory images of phonemes in the child's mind, as well as the composition of the rhythmic characteristics of words, phrases, sentences.

For the most part, children with severe speech disorders behave differently: they are distracted, do not make an effort to recognize the sound signal, understand its meaning. Children who listen (12% of those who were examined) play a beep (sound, word, phrase, short sentence) in 10-15 seconds. Measurement of the time-response to the signal covered the period from the filing of the signal and the response to it of the subject. The reproduction accuracy was not taken into account. The following manifestations were considered as reactions:

- correct playback;
- reflection;
- lesions of the lobes and surrounding muscles (depending on the nature and depth of the speech disturbance).

Significant difficulties associated with the perception of sounds, also found in children with impaired functions of the musculoskeletal system. They were manifested in determining the source of sound, the negative reactions to sounds, or their complete neglect (G. Zapatynska) [<http://enpuir.npu.edu.ua/handle/123456789/12351>].

The importance of the development of auditory perception, auditory responses is evidenced by the individual programs of sensory integration therapy used by the researcher, in particular, include "the ability to localize the source and trace the movement of the source of sound, the development of tolerance to a wider range of sound" (G. Zapatynska) [<http://enpuir.npu.edu.ua/handle/123456789/12351>].

Corrective measures for children with sensory and speech disorders are related to the acoustic characteristics of sounds, the availability of their auditory perception of a particular child. For children of different nosology, the recognition of infantile sounds is common, their differentiation, belonging to one or another source, etc. For children with hearing impairment, it is advisable to start working with low-frequency speech sounds, forming the image of a separate vowel, comparing it with the following, recognizing the composition, the word. This

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approach is also appropriate in working with children with severe speech disorders.

The process of maturation of the nerve impulses on the basis of the received acoustic image and the analysis of these impulses by the brain structures is the initial step of sensory and intellectual analysis / synthesis. The sooner these links are united (integrated, assimilated) in the child's mind, the more successful for the child to be prepared for the perception and understanding of speech information.

**Visual perception of speech.** The greatest experience of the peculiarities of visual perception of articulation images of phonemes has been accumulated in the theory and practice of surdopedagogy, which not only reveals the peculiarities of the physical and intellectual load of the child in carrying out these operations, but also indicates the reserves of its potential, the ability to non-specific manifestations of intellectual activity that is effective when teaching children with severe speech disorders. In the process of research, we turned to the sensory and intellectual capabilities of a child with hearing impairment (diagnosis – deafness).

Based on the fact that the implementers of the phonemes are available to the visual perception of the child (six vowels, п (б, м) – in Ukrainian, and sizzling, having the same articulation image (ш-ж, щ, ч – in Ukrainian), and in the speech acquire the position of the next loud (that is why we called them "conventionally visible"), the phonemic composition of the texts was analysed.

It turned out that theoretically, a child with a hearing impairment is not able to understand the speech addressed to her because she is able to understand only the third or even fourth part of the phonemic composition of the verbal text (without acoustic enhancement). On the basis of this limited information, in the perception of transient oral speech, 40-70% of children and adults with hearing impairment, to a greater or lesser extent, understood the meaning of what was said. 20% - understood the individual words, phrases and transmitted the approximate content of oral information.

Students and adults with complete hearing were practically unable to cope with this task, and they needed to set content based on the same phonemes, only in written form. They could come back to phonemes that were fixed on paper, to ponder. The tasks were mainly coped with only 15-20% of students. Their results are considerably inferior to those obtained in the analysis of the perception of oral speech by children and adults with violations of auditory function. These data indicate the unique potential of the trained visual perception of phonemes by the child and adults with violations of the auditory function. The ability to perceive, recognize and understand oral speech by a person with hearing impairment inevitably requires the activation not only of her visual perception, but also of

hidden and inaccessible, and inaccessible to the perception of information.

The effectiveness of activating the visual perception of "artificial implementers" was established and supported by studies of students (Masters S. Vasko, A. Podzhara) of the Institute of Human Sciences at Borys Grinchenko Kyiv University during 2014-2017, in which children with severe speech disorders were involved. As a result of the study, there was a positive dynamics in the development of perception, correction of phonetic and phonemic hearing, development of functions of remembering speech samples, improvement of attention, etc. Worthy of note is a unique case in working with a child with motor alalia. When presenting her to a well-known speech material, only articulation (naming of objects, drawings), without sound, was noticed by the movements of the circumspecific muscles, which, after six consecutive classes, were manifested in the sound of the child.

It is worth noting that the importance of incorporating the visual analyser into speech perception is underestimated in the correction work with children with special needs – the sensation of the position of the articulation bodies, the management of their position, visual perception of articulation movements, etc., can activate both sensory perception and speech on the basis of widespread use of intelligence a child whose activation is due to special, unusual conditions for the perception of speech signals.

**Tactile perception.** In the process of tactile perception is involved motor act, which is the trigger mechanism of cognitive activity as a natural phenomenon of behaviour of the child in terms of practical activity. In our study, which involved the students M. Abramenko, O. Babesha, L. Gunbin, K. Turlo, we intensified the cognitive activity of the child using tactile sensations that are able to expand the child's objective world, to give it new impressions from subjects, sharpen the sensation and enrich the sensory palette of emotions in the perception of objects, stimulate the development of perception, sensory and speech memory, thinking. Actions of a cognitive nature contribute to the generation of the need to master the child with new words, to enrich her vocabulary, to translate words from a passive stock into an active one.

Comparison of the visual and tactile-visual-motor perception of the subject by children with normal-type development and children with a general underdevelopment of speech indicate a greater efficiency of attracting a complex of analysers (visual, motor, tactile) to the perception and analysis of objects.

In particular, comparing the results of the subject's perception of children with norm-like development show the superiority of tactile-visual-motor perception before the visual (Fig. 1). Children with general underdevelopment of

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speech showed significantly lower results compared with the results of children with norm-type development (Figure 2). However, the tendency to improve the indicators of tactile-visual-motor perception compared with the visual remains.



Fig. 1. Perception of the subject by children with general underdevelopment of speech



Fig. 2. Perception of the subject by children with normal-type development of speech

The results obtained empirically in the process of experimental research, supported by an objective method of investigation by the method of encephalography. The study involved a group of preschool children with norm-type developmental indicators and children with general underdevelopment of speech.

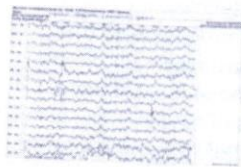
The study was conducted on the basis of the Institute of Otolaryngology AMS of Ukraine. As a result of the study samples of the encephalogram of 5 samples: background (№ 1) encephalogram, which recorded perception of the subject by sight (№ 2-3), as well as the perception of the subject tactile-visual-motor way (№ 4-5). An example of the results obtained in the child's encephalography with a general underdevelopment of speech confirmed subjective indices of the experimental

study of the effectiveness of visual and tactile-visual-motor perception. Description of the ~~background~~ background record showed the superiority of the asymmetry of the frontal segments on T4, F8. The reaction of the brain to the visual (№ 2, 3) and the tactile-visual-motor (№ 4, 5) stimuli was revealed, resulting in changes in rhythms following the leads in certain areas of the cerebral cortex (frontal, parietal, occipital), which confirms the expediency of activating sensory systems in the educational process of children with general underdevelopment of speech. Connecting to the tactile visual stimulus has affected the alpha rhythm gain.

### **Examples of encephalogram**

When visual irritation (visual perception of objects), peak excitation in the frontal lobe is observed, as well as asynchronous delta waves in the occipital areas of the cerebral cortex, as excitatory increases due to visual stimulation. In the visual test, a significant problem associated with eye movement is recorded, which leads to the EEG before the appearance of oculographic artifacts.

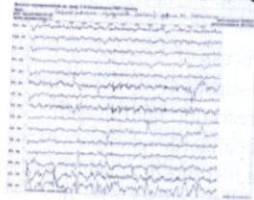
At tactile-visual-motor stimulation on the EEG, the fixation of the theta-rhythms F-8, T3, and T4 is noted, which testify to the emotional excitement of the child.



**№1. Background encephalogram**



**№2-3. Perception of the subject by sight**



**№4-5. Perception of the object tactile-visual-motor way**

Disorganization of alpha rhythms, increased synchronization of amplitude, shift of focus of activity from frontal lobe to occipital and parietal, weak and short



activation reaction, are the result of violation of psycho-motor development of the child.

Thus, the objective study by the method of encephalography of the functional state of the brain with visual and tactile-visual-motor perception of the subject allowed to reveal not only the features of the visual and tactile-visual-motor perception of various objects by children with general underdevelopment of speech, but also related indicators that are important for the formation of compensatory correction programs focused on the personality of the child, based not only on subjective indicators of her personal development and behaviour, but also on objective ones. In particular, the child needs correction of problems associated with eye movement, as well as psycho-motor development.

It has been established that auditory, visual, tactile (tactile-visual-motor) sensations in combination, capable of conveying a child with sensory and severe speech impairment is considerably more voluminous image of the combined sensory stimulus, which, with the corresponding intellectually secured presentation by the teacher, on the one hand, and the intellectual ability of the child to his "processing" from the other, causes a significant improvement in the process of mastering it speech. Therefore, all levels of perception and processing of the speech signal (pre-receptor, receptor and central-cortical) in the compensatory correctional plane are considered not only as physiological processes, but also intellectual.

In the development of compensatory correction techniques it is advisable to proceed from the fact that "the biological organs of the senses have characteristics that are far from perfect. Their characteristics are not linear, that is, between the input influence and the response to it there is no direct proportionality" (A. For, p. 20). Positive results in correctional work with children with special educational needs can be achieved both with the consistent improvement of their sensory base (priority in the development of one or another analytical system is determined, starting from the existing violation, its depth and individual peculiarities of child development), as well as intellectual abilities.

Some researchers (including L. Chystovych) reveal the essence of the model of perception and speech comprehension, which includes three successive components: the first-converts acoustic speech signals into a sequence of phonetic elements; secondly, it performs a morphological and parsing analysis, which can only partially be added to the understanding of the content. Only the third model is directly related to the intellectual interpretation of the content of speech.

If we turn to the psychological theory of S. Fesseden, then in it is given such a sequence of levels of semantic perception of speech:

- 1) establishment of the fact of obtaining information (without analysis and evaluation);

- 2) allocation of information from the general background of objects of perception;
- 3) correlation of received information with past experience (recognition);
- 4) assessment of perceived information, comparison to find out differences and similarities;
- 5) continuation of the subjective evaluation of the perceived information in order to identify the general meaning, subtext, etc.;
- 6) predicting the next course of events (the content of further information);
- 7) introspective assessment of the whole process (connecting the emotional sphere).

The deep essence of each of these stages requires a substantial rethinking of the modern methodical system of speech formation of children with sensory and speech disorders, based on the need to fumigate the key mental functions important for the intellectualization of speech signal processing, their memory, awareness, including the linguistic component (for example, recognition of the final affixes of verb-sentences, associate, who enter into semantic communication with them, that is effective in working with children with hearing impairments, visual functions, with severe speech disorders). To interpret the acoustic, visual (articulation) signal, sufficient linguistic experience is needed that will enable the perceptual level of speech signal analysis.

The level of formation of the skills and the perception and understanding of broadcasting of children with special educational needs can be expressed in the characteristics of succession and simultaneity. The succession presupposes the full deployment of all actions and operations, the decomposition of the speech stream into separate components, the establishment of the characteristics of individual signals and their relationships with specific speech elements. For a special child, it is necessary to ensure awareness of all components of the speech stream structure, reference signals, which allow for its sensory and linguistic analyses. Only the mastering of advanced analysis skills will provide synchronous synthesis for a child (or adult) with special educational needs and further curtailment of a succession analysis.

V.P. Zinchenko thinks that simultaneity, one-time perception and recognition are the result of training, in the initial stages of which a greater role is played by movements of receptor apparatus and further reduction of these movements. From this point of view, symmetrical perception is an instant recognition of the already known.

The study of the development of speech of children with sensory and speech disorders indicates that they have mature sensory systems and intellectual ability, analysis / synthesis, understanding of the content of information to some extent shifted in time, but with the help their development is activated and normalized.

Semantic perception, as a psychic function, is characterized by structural and has its own levels of formation not only in children with norm-type development, but also in those with special needs. The sound, visual, tactile signals arriving, the activity of their own articulation, the ability to mimic the sensory signals, reproduce, and predict the content of speech form in children with special needs, the dynamic nature of perception and intellectual activity, enable their productive communication and cognition.

In developing the theory of providing psychological and pedagogical conditions for the formation and development of specific intellectual activity in the perception and understanding of oral speech by children with special needs, the data of general psychology were taken into account, which testify that in the perception of oral speech, not only the formation of a perceptual function, but also the learning of linguistic signs and norms of operation of them. The consistent improvement of the functional state of analysers, combining them into a single system in the perception, analysis / synthesis of speech flow signals, activation of intellectual activity based on sensory stimuli provides children with sensory and speech disorders understanding of information and its assimilation.

The expediency of the integrative approach in developing effective methods, borrowed from the theory and practice of different nosology (teaching children with hearing impairment, vision, speech) is established. The development of auditory and visual perception of speech (acoustic, articulation images of phonemes), the development of tactile perception, aimed at activating cognitive processes, enriching the lexical composition proved to be effective in working with children both with sensory and speech disorders. Comprehensive use of analysers, the development of intelligence aimed at analysis, the synthesis of sensory signals provides the basis for the acquisition of speech, its perception and understanding of children with special educational needs.

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