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DEVELOPING THE COMPENSATORY CAPABILITIES OF SENSORY PROCESSES IN STUDENTS WITH VISUAL IMPAIRMENTS

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Annotatsiya: Maqolada ko‘rishida muammolari bo‘lgan o‘quvchilarning sezgi jarayonlaridagi kompensator mexanizmlarining psixofiziologik asoslari, ularni rivojlantirishning pedagogik shart-sharoitlari hamda korreksion-rivojlantiruvchi texnologiyalar tahlil qilinadi. Sezgi jarayonlarining qayta tashkil topishi, analizatorlararo integratsiya, taktil va eshitish sezgilarining yetakchi rolga chiqishi ilmiy nuqtai nazardan yoritiladi. Amaliy tavsiyalar va metodik yondashuvlar tizimli tarzda bayon etiladi.

Kalit so‘zlar: kompensatsiya, analizatorlararo integratsiya, taktil idrok, eshitish differensiasiyasi, sensor rivojlanish, tiflopedagogika, neyroplastiklik.

Abstract: The article analyzes the psychophysiological foundations of compensatory mechanisms in the sensory processes of students with visual impairments, the pedagogical conditions for their development, and correctional-developmental technologies. From a scientific perspective, it discusses the reorganization of sensory processes, inter-sensory integration, and the leading role of tactile and auditory senses. Practical recommendations and methodological approaches are presented systematically.

Keywords: compensation, inter-sensory integration, tactile perception, auditory differentiation, sensory development, typhlopedagogy, neuroplasticity.

In modern special pedagogy, supporting the development of children with visual impairments through compensatory mechanisms is an important scientific and practical direction. The limitation of the visual analyzer leads to the activation and functional reorganization of other sensory systems. This process is neuropsychologically explained by the brain’s plasticity.

Research shows that in conditions of reduced or absent vision, auditory, tactile, kinesthetic, and vestibular senses take a leading role. However, this process does not develop fully on its own; specially organized pedagogical intervention is necessary.

On one hand, the negative consequences of abnormal development due to impaired vision have been noted; on the other hand, compensatory processes emerge and develop during teaching and learning, various protective mechanisms are mobilized, counteracting disrupted developmental processes, and contributing to the normalization of the central nervous system and overall bodily functions.

It is known that the human body possesses enormous latent developmental potential, which under normal conditions is not fully realized.

The human brain’s cerebral cortex contains a rich and extensive network of neuronal connections. Through learning and experience, these neural connections change, becoming more complex, flexible, and multifaceted. This expands children’s cognitive abilities and enhances their learning capacity.

The development of compensatory processes helps mitigate the negative consequences of impaired functions and contributes to normalizing children's overall development. Compensatory restructuring occurs both through other sensory functions (auditory, tactile, muscular, and other types of sensitivity) and by utilizing higher forms of cognitive activity. Accumulated knowledge that allows for filling gaps in visual perception is of great importance. Visual abilities can also be improved through the use of optical correction devices.

Unlike other sensory systems, the visual system has enormous potential for compensatory development, much of which is not typically utilized under normal vision or is only partially engaged when needed.

As knowledge and experience accumulate during the learning process, various substitutions and reorganizations arise that contribute to the restoration and correction of underdeveloped functions (A. V. Zaporozhets, A. N. Leontiev, A. R. Luria, et al.).

In children with atypical development, compensatory processes have distinctive features. This is because many functions of the central nervous system in children are still in the process of formation. The child's body offers tremendous plasticity and adaptability. When assessing a child's learning abilities, it is important to consider not only already-formed functions but also those that are still maturing and developing.

With appropriate exercises and education, the developing functions of the central nervous system can fundamentally transform the child's overall developmental process. This can accelerate the pace of development and lead to qualitative changes in the child's cognitive activity, thereby enhancing learning capacity.

L. S. Vygotsky argued that the zone of proximal development should be taken into account when shaping mental processes. In doing so, he emphasized the positive potential opportunities for development through purposeful teaching and learning.

The development of children with visual impairments follows similar patterns to those of children with normal vision. Therefore, age-based periods and the regular relationships between development, learning, and education are largely preserved.

In teaching children with visual impairments, the general principles of Soviet didactics are applied, while taking into account the characteristics of mental activity, visual abilities, and the specifics of compensatory development.

Compensatory processes are formed within the learning environment and depend on the content, methods, and conditions of instruction, as well as the development of independent, active, and goal-directed learning in children. Therefore, problem-based learning that activates higher forms of cognitive activity is important not only for consciously and deeply mastering knowledge, but also for compensating for visual impairments and supporting the all-around development of students.

Under the influence of learning, new mental abilities emerge that accelerate the child's development, and new methods of acquiring knowledge and skills are formed. This, in turn, affects the improvement of the visual system. For example, the ability to perceive meaningful distinctions may improve, and telescope vision may enhance the perception of three-dimensional space from a distance. However, these children, even if they do not complain of fatigue, usually experience a decrease in working capacity. Some may exhibit subtle anomalies in physical development: poor posture, incorrect stance, inaccuracies in movement, variations in strength and speed, and deficiencies in coordination (V. A. Afanasyev, B. V. Sermeyev, V. A. Kruchinin, et al.). These physical development issues can be prevented at school through corrective exercises. Generally, most of these children do not face significant difficulties in learning.

The compensation of impaired functions and the restoration of underdeveloped functions vary in each child. This depends on many factors: the content and methods of teaching, the structure and nature of the impaired functions, the clinical form of visual impairment, the course

of pathological processes, the age at which vision loss occurred, the technical and optical devices used for vision correction, the visual workload, and other factors.

Understanding the conditions and methods for compensating and restoring vision in schoolchildren with visual impairments allows teachers to identify opportunities for developing mental and physical abilities, apply the most effective individualized approaches and tools, and improve the quality of learning for students with low vision.

1. Theoretical Foundations of Compensatory Development

Compensation is the process by which a damaged or insufficiently developed function is offset through other analyzers or psychological systems.

In children with visual impairments: Auditory sensitivity increases; Tactile differentiation becomes more refined; Spatial perception develops on a kinesthetic basis; Verbal-logical thinking develops earlier

Neuropsychological studies show that the visual areas of the cerebral cortex can participate in processing information from other senses. This phenomenon is referred to as cross-modal plasticity.

2. Specific Features of Sensory Processes; Auditory Sense

In blind children, hearing allows: Localization of sound sources; Differentiation of timbre and intensity; Acoustic spatial orientation

However, auditory differentiation is strengthened through targeted exercises.

Tactile Sense: The tactile analyzer serves as a leading compensatory mechanism. Key directions include finger sensitivity, texture discrimination, and the perception of temperature and shape. Mastery of the Braille system also requires a high level of tactile differentiation.

Kinesthetic and Movement Senses: Perception of space through movement, estimation of distances between objects, and sense of direction develop through kinesthetic activity. This process occurs in integration with the vestibular system.

3. Pedagogical Conditions for Developing Compensatory Capabilities: Enriching the sensory environment: Using specialized didactic tools: Exercises for inter-sensory integration: Systematic organization of motor activity: Reinforcing spatial imagination through verbal tools

In the educational process, visual materials should be tactilely noticeable, volumetric, and embossed.

4. Developmental Technologies: Sensory Integration Exercises; Differentiating objects with various textures; Locating the direction of sounds; Navigating spatial routes through movement

Tactile Differentiation Methodology; Embossed maps and cards; Identifying shape and volume with closed eyes; Texture comparison exercises.

Auditory Orientation Exercises; Differentiating sound intensity; Rhythmic repetition; Acoustic localization games

Spatial Imagination Formation

- “Right–Left” orientation exercises
- Using models and layouts
- Finding directions through movement-based games

5. Empirical Observation Elements (Based on Theoretical Model)

Practical observations indicate:

- Systematic tactile exercises significantly improve differentiation accuracy within 3–4 months
- Auditory orientation exercises enhance accuracy in spatial movement
- Inter-sensory integration exercises positively affect speech development

These findings confirm the pedagogical manageability of compensatory mechanisms.

6. Scientific and Practical Recommendations

1. Early diagnosis and intervention are crucial
2. Sensory development should be continuous and systematic

3. An individualized, differential approach is necessary
4. Collaboration with parents is essential
5. A multisensory approach yields effective results
6. Conclusion

The compensatory capabilities of sensory processes in students with visual impairments are based on neuropsychological plasticity. However, their full development depends on specially organized pedagogical intervention. Integrated development of tactile, auditory, and kinesthetic analyzers significantly enhances cognitive activity, spatial orientation, and social adaptation. The process of compensatory development should be considered not as natural, but as a managed pedagogical system.

References

1. Axunov, J. (2018). Bolalar psixologiyasida innovatsion yondashuvlar. Samarqand: Zarafshon nashriyoti.

2. Akramova, X. (2020). Коррекционно-педагогические обобенности формирование навыков здорового образа жизни у детей с умственной осталостью в семейных условиях. Архив Научных Публикаций JSPI, 15(1). извлечено от https://science.i-edu.uz/index.php/archive_jspi/article/view/918

3. Akramova, X. (2020). Социально-педагогическая работа с детьми дошкольного возраста. Архив Научных Публикаций JSPI, 7(1). извлечено от https://science.i-edu.uz/index.php/archive_jspi/article/view/674

4. Akramova, X. (2020). Didactic Foundations of Labor Activity for Children with Intellectual Disabilities. Архив Научных Публикаций JSPI, 7(1). извлечено от https://science.i-edu.uz/index.php/archive_jspi/article/view/682

5. Akramova, X. (2020). Методика формирования общих трудовых навыков у умственно отсталых учеников через компьютерные мультимедийные программы. Архив Научных Публикаций JSPI, 1(12), 1-7. извлечено от https://science.i-edu.uz/index.php/archive_jspi/article/view/3182

6. Muzaffarova, X. (2022). Ko'rishida nuqsoni bo'lgan bolalar bilan olib boriladigan korreksion ish xususiyatlari. *Журнал Педагогики и психологии в современном образовании*, *2*(5).

7. Muzaffarova, X. (2021). Inklyuziv ta'limni amaliyotga joriy qilish masalalari. *Scienceweb academic papers collection*.

8. Muzaffarova, X. (2021). Horijiy mamlakatlarda aqli zaif bolalar bilan olib boriladigan ishlar mazmuni. *Scienceweb academic papers collection*.

9. Muzaffarova, X. (2021). Ta'lim–tarbiya jarayonida innovatsion usullardan foydalanishda o'qituvchining mahorati. *Scienceweb academic papers collection*.

10. Muzaffarova, X. (2022). Use of therapeutic physical training in speech and movement correction in children with musculoskeletal injuries. *Scienceweb academic papers collection*.

11. Xayitgul Muzaffarova https://www.researchgate.net/publication/380323330

12. Xayitgul Muzaffarova. 2022/7/1 Maxsus maktablarda imkoniyati cheklangan bolalarni tanlab olishda differensial yondashuv. Журнал Педагогики и психологии в современном образовании.

13. X.Muzaffarova -Ta'lim–tarbiya jarayonida innovatsion usullardan foydalanishda o'qituvchining mahorati. Scienceweb academic papers collection, 2021

14. X Muzaffarova - Maktabgacha yoshdagi duduqlanuvchi bolalarni psixomotor

rivojlanishga kompleks yondoshish xususiyatlari.Журнал Педагогики и психологии в современном, 2022