

# THE ROLE AND SIGNIFICANCE OF THE NEUROGYMNASTICS METHODOLOGY IN CORRECTIVE-DEVELOPMENTAL EDUCATION

Khikmatova Shokhida Khikmatovna

Teacher of the Department of Continuing Education Pedagogy, Oriental University

## Abstract

This article presents a scientific examination of the theoretical foundations, practical application, and effectiveness of the neurogymnastics — or "brain gym" — methodology in corrective-developmental education. The influence of cerebral hemisphere asymmetry and interhemispheric integration problems on the educational process is analyzed. The role of a movement exercise system, developed on the basis of Paul Dennison's methodology, in correcting speech and cognitive disorders is substantiated. The article also outlines the diagnostic indicators of interhemispheric dysfunction and the methodological principles of corrective intervention.

**Keywords:** neurogymnastics, brain gym, interhemispheric integration, corrective pedagogy, speech disorders, Paul Dennison, sensory integration, myelination, frontal lobes, movement therapy.

## Introduction

In the modern educational system, providing corrective assistance to children with developmental disorders is regarded as one of the priority directions. In recent decades, new approaches emerging at the intersection of neurology, neuropsychology, and pedagogy have been significantly enriching traditional corrective methods. One of these approaches — neurogymnastics, a system of specialized movements developed with consideration of the neurophysiological characteristics of the brain — is finding increasingly wide application in working with children who face educational difficulties.

Difficulties in mastering reading, writing, and arithmetic among school-age children are often interpreted solely as a pedagogical problem. However, modern neuropsychological research demonstrates that the majority of such difficulties can be traced back to insufficiently developed integration between the brain's two hemispheres. Deficiencies in interhemispheric connections manifest as impairments in visual-motor coordination, underdeveloped spatial perception, and delays in speech functions.

In the search for comprehensive solutions to these problems, the "brain gym" methodology developed by American educational specialist Paul Dennison in the early 1970s holds particular scientific and practical significance. This methodology enables the harmonization of the brain's



hemispheres through movement, the reinforcement of interneuronal connections, and through these means, the development of cognitive and speech functions. The scientific investigation of the methodology's application in corrective education, its theoretical foundations, and practical effectiveness remains a pressing scholarly task.

## 2. Neurophysiological Foundations of Brain Hemisphere Integration

The human brain is a complex structure, and one of its most important characteristics is functional asymmetry. The right hemisphere controls the left side of the body, as well as sensations received through the left eye and left ear; the left hemisphere, conversely, governs the right side of the body. In addition to this anatomical feature, the hemispheres also distribute various cognitive functions: the left hemisphere is typically associated with logical-verbal functions, while the right is associated with spatial-artistic functions.

The efficiency of brain activity depends greatly on the quality of communication between these two hemispheres. The primary structure connecting the hemispheres — the corpus callosum — consists of millions of neural fibers and ensures the transmission of information from one hemisphere to the other. In the early stages of development, these connections are not fully formed, and the maturation of the corpus callosum is a process that extends over a long period of ontogenesis.

Immediately after birth, the hemispheres operate almost independently of one another. During the first three years of life, the fibers connecting the hemispheres gradually mature, enabling the bidirectional transmission of information — from right to left and from left to right. This process continues throughout the first decade of a child's life, but its most intensive phase coincides with the sensitive period between the ages of three and five.

Information from the external world is processed by various areas in both hemispheres of the brain: the temporal, parietal, occipital, and central regions are jointly engaged in this process. The processed data is then transmitted to the frontal cortex, where emotional enrichment and integration with memory take place. The frontal cortex plays a decisive role in selecting behavioral and movement strategies in any given situation.

Various factors — including perinatal pathologies, birth injuries, and asphyxia — can cause deviations and delays in the development of interhemispheric connections. Such conditions manifest during early school age as interhemispheric dysfunction, presenting as difficulties in mastering reading and mathematics, and as coordination disorders in bilateral hand movements. While this problem is complex and multifactorial, it is in many cases considered the primary cause of school failure.

## 3. Diagnostic Criteria of Interhemispheric Dysfunction

Various neuropsychological diagnostic methods are used to identify interhemispheric dysfunction. While equipment-based methods yield highly accurate results, functional tests that do not require specialized apparatus are also widely used in practical corrective work. These tests enable assessment of a child's bimanual coordination ability — the capacity of both hands to move simultaneously and in a coordinated manner.



A palm-rotation test is one of the standard diagnostic methods. In this test, the child is asked to rapidly rotate both palms simultaneously — one with the palm facing upward and the other with the back of the hand facing upward. The speed of performing mirrored and oppositional movements is measured separately. According to normative indicators, children aged five to seven complete twenty mirrored movements in approximately eight seconds, and twenty oppositional movements in approximately seventeen seconds.

A finger-tapping test also serves as an important diagnostic tool. The task involves tapping as quickly and continuously as possible with the index finger of the dominant hand; on average, children aged five to seven complete twenty taps in four to six seconds. The rhythmic bimanual tapping test assesses the ability to smoothly alternate from one hand to the other: the right and left hands take turns operating in a specific rhythmic sequence, and the time taken to complete this sequence is measured.

A significant deviation in diagnostic indicators from normative values indicates insufficiently developed interhemispheric integration. Such children often also present the following clinical signs: mirror writing; substitution of spatially similar letters (such as the pairs s-e and b-d); confusion of acoustically or articulatorily similar sounds; losing one's place in a line or re-reading the same word; and disruptions in the sequential processes of combining letters into syllables and syllables into words.

Children with frontal cortex dysfunction also display characteristic behavioral patterns: difficulties transitioning from one type of activity to another, inability to plan actions, and inability to complete goal-directed activity. Impairment of the right frontal region causes difficulties in perceiving speech intonation and the emotional dimension of language. Dysfunction of the temporal regions may manifest as excessive aggression, depression, or disproportionate positive emotions.

#### **4. Theoretical Foundations and History of the Neurogymnastics Methodology**

The "brain gym" methodology was developed by American educational specialist and neuropsychologist Paul Dennison in the early 1970s, and constitutes a component of the broader system known as Educational Kinesiology. The scientific foundation of Dennison's methodology is grounded in fundamental research in the fields of higher nervous activity, neurophysiology, and educational psychology.

The core idea of the methodology is that certain movements activate and strengthen the connections between brain neurons. In particular, midline-crossing movements — that is, movements that cross the body's central axis from one side to the other — activate both hemispheres simultaneously, thereby stimulating information exchange between them. This principle is neurophysiologically grounded: the activity of the motor cortex ensures interhemispheric coordination via the corpus callosum.

The history of the methodology shows that Dennison initially, in 1974, asked students to draw the shape of a "lazy eight" on a board. This movement engages the body's large muscles and activates the ability to perceive left-right directions. Practice demonstrated that after the exercise, students began to distinguish graphic symbols more easily and ceased confusing



directional concepts. This observation served as the impetus for the methodology's subsequent development.

The "brain gym" system is also grounded in contemporary neuropsychological conceptions regarding the unity of intellect and bodily movement. According to this approach, cognitive activity and physical movement are not separate phenomena, but rather mutually related processes within a unified neural system. From this perspective, learning through movement is not merely physical exercise, but a neurophysiological process that ensures integration between the cognitive and motor regions of the brain.

Clinical observations and practical experience confirm that neurogymnastics exerts a positive effect on the formation of reading and writing skills in school-age children. The methodology also demonstrates efficacy in correcting speech disorders in children, regulating attention, and addressing behavioral problems.

### **5. Myelination and the Neurophysiological Mechanisms of Neurogymnastics**

In order to understand the mechanisms by which neurogymnastics operates, it is necessary to consider myelin and the process of myelination. Myelin is a structure composed of fatty layers in nerve tissue that ensures the accelerated transmission of nerve impulses along nerve fibers. Impulses travel along myelinated fibers considerably faster than along unmyelinated fibers, which increases the overall efficiency of information processing.

Neurophysiological research indicates that the more frequently nerve fibers are stimulated through activity, the more layers of myelin form around them. This process strengthens the connections between neurons and makes information transmission more efficient. Particularly in children, this process is characterized by high plasticity — that is, the child's brain undergoes rapid and effective changes under the influence of specific movements and activities.

In the "brain gym" exercises, movements that stimulate the activity of the frontal lobes hold a special place. Impulses originating from the frontal lobes activate myelination of nerve fibers throughout the brain, thereby accelerating the formation of patterns and information systems required in subsequent stages of learning. Human beings engage in movement from the very beginning of life, and the more active and varied a child's movements are during development, the more robust the neuronal foundation for the future formation of reading and language skills.

Another important mechanism of neurogymnastics is related to sensory integration. The methodology simultaneously stimulates the cerebellum and develops sensory integration. The cerebellum is responsible for the coordination of muscles and the precision of movements; through its activation, overall movement culture, eye-hand coordination, and spatial orientation are improved. Sensory integration refers to the ability to combine information from various sensory channels, and it constitutes one of the fundamental prerequisites for effective learning. Biochemical and electrical interaction mechanisms also help explain the effectiveness of neurogymnastics. During movement, effective electrical and biochemical interactions between the brain and the spinal cord are enhanced. This, in turn, increases the ability to efficiently assimilate information and retrieve it when needed, improves the capacity to concentrate attention, and reduces mental fatigue.



## 6. Corrective-Pedagogical Classification of Neurogymnastics Exercises

The exercises in the "brain gym" system are classified according to various criteria. The most widely used classification in pedagogical practice is based on the functional orientation of the exercises. According to this classification, the exercises are divided into three main groups: midline movement exercises, stretching exercises, and energizing exercises.

Midline movement exercises are aimed directly at activating interhemispheric integration. They include all movements that cross the midline: left knee-right elbow or right knee-left elbow coordination, and exercises that enable the eyes to move freely from one side of the midline to the other. The "Lazy Eight" exercise — tracing a horizontal figure-eight shape (⌘) in the air using writing or the index finger — engages eye movements and both hemispheres simultaneously.

The "Alphabet Eight" exercise also belongs to this group, incorporating the writing trajectory of letters into the figure-eight shape. Corrective practice confirms that this exercise is particularly effective for developing graphomotor skills, enabling children to master the configuration of letters more quickly and durably. The "Letters in the Palm" exercise serves to develop tactile and kinesthetic abilities, facilitating the perception of graphic symbols and their consolidation in memory.

The "Elephant" exercise is also among the widely used methods in corrective practice, aimed at relaxing the muscles of the head and neck, developing eye-neck coordination, and strengthening the integration of hearing and vision. This exercise not only regulates the tone of the neck and eye muscles, but also exerts a positive influence on the development of auditory function. Specialized corrective studies have shown that regular performance of the "Elephant" exercise helps improve auditory attention and phonemic perception in children with delayed speech development.

The group of energizing exercises is designed to restore overall body tone and attention, and is applied before intensive intellectual activity or during breaks. Stretching exercises serve to normalize muscle and tendon-ligament tone and to develop voluntary control of reflex movements. In the comprehensive application of the methodology, all three groups of exercises are used in conjunction, enabling a systematic and multi-stage effect.

## 7. The Role of Neurogymnastics in Correcting Speech Disorders

The role of neurogymnastics in the correction of speech disorders is closely related to the methodology's direct effect on the frontal lobes. It is well established that children with speech problems exhibit dysfunction precisely in the frontal lobes. By activating this region — responsible for speech production and its voluntary control — neurogymnastics indirectly assists in the restoration of speech functions.

Experience with applying neurogymnastics in speech therapy practice shows that children successfully master bilateral hand coordination movements and eye-motor reactions, as well as skills that support effective learning in reading, writing, and behavioral self-regulation. This in turn creates a favorable foundation for the development of verbal-communicative skills. It is well known that children with speech difficulties subsequently encounter serious challenges in



mastering written language — reading and writing — making such a preventive approach of great significance.

Impairments in visual-motor coordination and underdeveloped spatial perception constitute one group of reading and writing disorders. Neurogymnastics exercises are directly aimed at correcting such disorders by developing visual-motor coordination. The use of midline-crossing exercises in addressing mirror writing, and in working with cases of substitution of spatially similar letters, reduces the time needed to achieve a corrective outcome.

Motor disorders manifest as slow writing speed, hand tremors, and working under great strain in writing. This condition is associated with insufficiently developed fine motor skills and difficulties in their voluntary control. Neurogymnastics exercises exert a dual effect on this problem: on one hand, they develop kinesthetic and tactile abilities; on the other, they stimulate fine motor skills and prepare the hand muscles required for writing.

As emphasized in the research of M.A. Povalyaeva (1997, 2001, 2005), the "brain gym," as a methodology that helps overcome hemispheric asymmetry, serves to expand a child's compensatory potential. It is known that an infant is born with nearly equivalent hemispheres, but by the age of two or three this balance is disrupted, their specialization takes place, and a dominant hemisphere emerges. In cases of disorder, this specialization process may proceed incorrectly, and neurogymnastics is in such cases regarded as an effective tool of corrective intervention.

### **8. Methodological Principles for Organizing Neurogymnastics in Speech Therapy Groups**

Specific methodological principles exist for organizing neurogymnastics sessions in speech therapy groups. Practical experience shows that for the effectiveness of sessions, it is recommended to conduct them regularly — at least twice a week. Conducting sessions in a small group format (typically four to six children) creates the opportunity for an individual approach to each participant and facilitates the teacher's supervisory function.

Each session plan is carefully thought out in advance and structured in accordance with the developmental characteristics of the children, diagnostic results, and corrective goals. It is recommended to include a greeting ceremony, a main movement segment, "fun breaks," and a farewell ceremony in each session. The use of music therapy elements also yields positive results: movements performed against a backdrop of music with a defined order and rhythm are assimilated more effectively.

The behavioral characteristics of children in speech therapy groups must also be regarded as a factor complicating corrective work. Many children exhibit balance disorders, irritability, tearfulness, restlessness and anxiety, apathy, hyperactivity or hypoactivity, and difficulties in communication with children and adults. In such cases, neurogymnastics serves corrective goals not only in the cognitive domain, but also in the emotional-volitional sphere: it reduces stress, enhances adaptive capacity, and develops communication skills.

The educator's methodological approach must be grounded in the child's compensatory potential. From the perspective of holistic personal development, in the process of performing neurogymnastics exercises the child gains the experience of self-awareness as an individual: learning to perform an exercise correctly, perceiving the result, and rejoicing in success. This



fosters motivational-volitional processes and serves to strengthen the capacity for self-regulation.

Combining neurogymnastics exercises harmoniously with movement games and relaxation exercises is also one of the important methodological principles. The educator also makes use of the movements children have learned in relaxation sessions aimed at relieving muscle tension, which allows a single exercise to be repeatedly reinforced in different contexts. Furthermore, the integration of neurogymnastics with traditional speech therapy methods — articulation gymnastics, exercises for developing phonemic hearing, and work on forming lexical-grammatical skills — significantly increases the effectiveness of the corrective process.

### 9. The Effect of Neurogymnastics on Educational and Cognitive Functions

The effect of neurogymnastics on educational and cognitive functions covers a wide spectrum. The exercises harmonize the activity of the brain's hemispheres, improve the quality of retention, increase attention stability, and enhance intellectual work capacity. These effects are observed not only in children with developmental disorders, but also in typically developing children; the methodology can therefore be applied in a preventive and general developmental context beyond corrective purposes.

The enhancement of the ability to efficiently assimilate information and retrieve it when needed is one of the most important effects of neurogymnastics. This is directly connected to memory mechanisms: improvement in interhemispheric integration enables information to be encoded both verbally and visually-spatially, which ensures the consolidation of memory traces. Improvement in the ability to concentrate attention is also linked to a reduction in mental fatigue, which manifests as an increase in session duration and an enhancement of educational effectiveness.

Improvement in thinking and physiological coordination is another important effect of neurogymnastics, helping to address many difficulties associated with "neurological switching." By "neurological switching" is meant the situation in which, while a child is performing a given cognitive task, one hemisphere of the brain is blocked while the other is overburdened. Neurogymnastics overcomes this state and ensures the balanced cooperation of the hemispheres.

The effect of neurogymnastics on the ability to move and participate in various activities is also noted. This effect is related to overall motor development and enables the child to participate more actively and successfully in play and academic activities. Its property of facilitating all types of learning demonstrates the universality of the methodology: it covers a wide range, from language and literacy skills to mathematical and logical thinking abilities.

### 10. Conclusion

On the basis of the foregoing, the following conclusions may be drawn. Neurogymnastics, or the "brain gym" methodology — as a systematic approach that optimizes brain functions through movement and is grounded in the scientific foundations of modern neurophysiology and neuropsychology — occupies an important place in corrective-developmental education. The effectiveness of the methodology is associated with neurophysiological mechanisms



directed at ensuring the cooperation of the brain's hemispheres, accelerating the process of myelination, and developing sensory integration.

Interhemispheric dysfunction — one of the most common causes of educational failure in school-age children — can be effectively corrected through neurogymnastics. Functional diagnostic methods enable the identification of this dysfunction even without specialized equipment, which facilitates the broad application of the methodology in general pedagogical practice.

The regular and systematic application of neurogymnastics exercises in speech therapy groups leads to comprehensive positive changes in the speech, cognitive, and emotional-behavioral domains. Children successfully master bilateral hand coordination, eye-motor reactions, reading and writing skills, as well as the ability to regulate their behavior. The integration of the methodology with traditional corrective methods significantly increases the overall effectiveness.

Determining appropriate corrective-developmental assistance for children with health problems and emotional-personal or speech developmental difficulties requires interdisciplinary cooperation and mutually coordinated activity among specialists. Within this cooperation, neurogymnastics — uniting the work of the speech therapist, psychologist, and defectologist — serves as a non-traditional yet scientifically grounded form of corrective assistance, exerting a gentle influence on children with developmental difficulties while ensuring the child's psychological comfort.

Future research would be best directed toward a detailed quantitative and qualitative investigation of the effects of the neurogymnastics methodology on children of various ages and diagnostic groups, toward issues of adapting the methodology to the national education system and local corrective-pedagogical traditions, and toward its application in digital and interactive formats.

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