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# Neuroexercises As A Means Of Developing Cognitive Abilities In Children Of Primary School Age

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**ABSTRACT**

The article discusses the use of neuroexercises as an effective means of developing cognitive abilities in children of primary school age. The relevance of the topic is due to increased demands on the cognitive development of modern schoolchildren and the search for new teaching methods. The results of a number of modern studies show that the systematic use of neuroexercises leads to a significant improvement in memory, attention, academic performance and executive functions in primary school children. Neuroexercises are a promising tool in neuropedagogy, contributing to the formation of strong neural connections and the harmonious development of the cognitive sphere of children.

**Keywords:**

neuroexercises, methodology, language barrier, cognitive abilities, memory

**Relevance.** The development of cognitive abilities in primary school age is crucial for the subsequent success of learning. Primary school is considered a sensitive period of intensive development of cognitive functions and formation of basic learning skills [1]. However, modern children are faced with an increasing volume of information and high academic workloads, which often leads to difficulties in concentration, memorization and self-control [2]. Educators note that more and more primary school children experience problems with voluntary attention and memory, many experience increased distractibility and fatigue. In these conditions, the search for effective means of supporting cognitive development is particularly relevant.

The neuropsychological approach to education offers the integration of knowledge about the brain into pedagogical practice [3]. Neuroexercises are special tasks and game

methods aimed at activating various areas of the brain and forming new neural connections. Unlike traditional methods, neuroexercises combine physical activity, sensory stimulation and cognitive tasks, providing a holistic effect on the child's psyche. In recent years, the term "neuropedagogy" has emerged, reflecting an interdisciplinary approach that combines pedagogy, psychology and neurobiology to optimize learning. Research in 2020–2025 indicates a growing interest in neuroexercises and neurogymnastics as ways to improve the effectiveness of children's learning and development. Experimental data indicate that such exercises can improve cognitive performance even in children without obvious deviations, and not only be used to correct developmental problems [4]. All this justifies the relevance of a detailed study of neuroexercises in the context of primary school.

**The aim of this work** is to analyze and summarize modern data on neuroexercises as a means of developing cognitive abilities in primary school children.

Based on the literature analysis, three main categories of neuro-exercises used in working with children can be distinguished: sensorimotor, breathing (relaxation) and cognitive. Each category is aimed at developing certain cognitive functions and provides a different impact on the child's brain activity.

1. **Sensorimotor neuroexercises** . This category includes motor and kinesiological exercises that simultaneously engage the body and brain. Examples: exercises for coordination of movements, balance, "cross" movements (when the left hand touches the right knee and vice versa), finger gymnastics, eye movements. Sensorimotor tasks improve interhemispheric interaction and synchronization of different areas of the brain. Thus, it is known that eye movement and associated motor activity affect the development of interhemispheric connections, which has a beneficial effect on the cognitive development of the child. By developing eye-hand coordination and gross motor skills, such exercises strengthen the basic neural networks responsible for spatial perception, visual attention and working memory. In addition, fine motor exercises (for example, fingering, drawing with both hands at the same time) stimulate the speech and thinking centers of the brain. In domestic neuropsychology, it is noted that the formation of fine hand movements is closely related to the development of speech and thinking of the child. Thus, sensorimotor neurogymnastics creates a foundation for higher cognitive functions, increasing the readiness of the nervous system to perceive and process information. For example, the inclusion of short motor neuropauses in a lesson (in the form of physical education minutes with elements of "brain gymnastics") helps to switch and refresh the attention of students, activate both hemispheres before performing complex intellectual tasks.

2. **Breathing and relaxation exercises**. This category of neuro-exercises is aimed primarily at regulating the level of activation of the central nervous system and the emotional

state of the child. A properly organized breathing exercise (deep inhalations and exhalations, counting breathing, alternating nostrils, etc.) helps saturate the brain with oxygen and normalize the breathing rhythm. As a result, excessive emotional excitability and hyperactivity are reduced, the child calms down, and the level of anxiety decreases. Such exercises develop self-regulation skills and voluntary concentration of attention - a primary school student learns to manage his or her state, which has a positive effect on cognitive activity. For example, a simple exercise "raise your shoulders on inhalation - lower them on exhalation" performed by the whole class can help relieve muscle tension and fatigue, restoring the working capacity of attention. Studies show that systematically performing short relaxation -breathing pauses increases overall performance and mental productivity in primary school children [5]. Thus, breathing neuroexercises indirectly support the development of cognitive functions, creating an optimal internal background (calmness, cheerfulness) for effective learning.

3. **Cognitive exercises and neurogames** . This category includes tasks that directly train higher mental functions - attention, memory, thinking, perception. Most often, they are performed in a game form or using special stimulus materials. Examples: games for memorizing sequences (numbers, words), searching for extra elements, puzzles and logical problems, exercises for switching attention (for example, the game "Simon Says" or its analogues), computer neurogames for developing memory and reaction. Cognitive neuroexercises are specially designed for targeted training of certain brain functions, due to which their selective improvement is achieved [6]. Thus, regular games for the development of working memory lead to an increase in the volume of memorized information, tasks for voluntary attention teach children to maintain concentration on a task longer, and solving logical puzzles train flexibility of thinking and the ability to solve problems. An important characteristic of neurogames is their fascination: children perform them with interest, which increases

motivation for learning. In addition, many neurogames require simultaneous activation of different analyzers - visual, auditory, motor - thereby involving several areas of the brain at once and strengthening intersensory connections. According to I.A. Kisil, neuropsychological exercises activate a complex of mental functions (perception, memory, attention, thinking), stimulating the general mental activity of students. Thus, cognitive neuroexercises directly develop those cognitive abilities, the level of development of which largely determines the academic performance of primary school students.

It is important to note that the listed categories of neuro-exercises are not isolated from each other. In practice, complex approaches are often used, combining, for example, motor activity with the simultaneous performance of a cognitive task (simultaneous pronunciation of educational material and performance of a movement). This integrated nature of neuro-exercises provides a more powerful impact on the child's brain and allows developing several abilities at once. In addition, the principle of gradual complication underlies the neuro-training methodology: first, children master simple exercise options, then the tasks become more complex (coordination complexity increases, the amount of information to memorize increases, etc.). Compliance with these principles - cyclicity, gradual complication and regularity - is the methodological basis for the effectiveness of neuro-exercises.

**Results.** Modern research conducted in 2020–2025 provides convincing quantitative data on the effectiveness of neuro-exercises for the development of the cognitive sphere of primary school students. Let us highlight some of the key results recorded in the scientific literature.

Firstly, numerous studies show improvements in attention and memory in children who regularly perform neurogymnastic exercises. For example, N.D. Shtin notes that the inclusion of neuropsychological games in a lesson helps both hemispheres of the brain to work synchronously, allowing children to better focus on the material and remember information. As a result, short-term memory improves and

students' attention stability increases. The study by I.A. Kisil provides data showing that the use of a set of neuroexercises triggers memory and attention processes, stimulates the mental activity of schoolchildren, which leads to increased learning productivity. Quantitatively, this is manifested, for example, in an increase in the volume of reproduction of the material covered or in a decrease in the number of errors when performing attention tasks after a course of exercises on neuropsychological correction.

Secondly, the development of executive functions (subject cognitive skills) also improves under the influence of targeted cognitive training. Foreign studies using computerized neuro-exercises show a statistically significant increase in working memory, cognitive flexibility and the ability to inhibit impulsive reactions in primary school children after training. Thus, the experiment of K. Rosales et al. with the participation of 95 schoolchildren demonstrated a significant increase in the results of tests for working memory, information processing speed and attention switching after completing a program of cognitive exercises during the school day. Moreover, the maximum effect was observed with a sufficient duration of training - 10-12 hours of total classes: it was after this threshold that the improvements in cognitive abilities became reliable. Another study (Y. Wu et al., 2023) on a sample of 127 children aged 6–12 years with attention deficit hyperactivity disorder showed that 48 sessions of neurocognitive training over 2 months led to a decrease in inattention and impulsivity (the total score on the ADHD-RS scale decreased, the improvements reached significance  $p < 0.05$ ) and simultaneously improved the results of executive function testing (according to the neuropsychological tests CANTAB). These results confirm that even in children with developmental disabilities, the use of neuroexercises can strengthen basic cognitive skills of self-control, planning and memory.

Thirdly, neuroexercises have a positive effect on academic performance and learning skills, indirectly through the development of the cognitive sphere. Suranova T.A. et al. (2022) in their study came to the conclusion about the

need to introduce a set of "brain gymnastics" exercises into the practice of primary schools after the experimental classes demonstrated an improvement in mental performance and academic performance compared to the control. In particular, children who performed Dennison kinesiological exercises showed an increase in concentration in lessons and an increase in average scores in a number of subjects. An illustrative example of a study in Spain: 196 primary school children underwent an 8-week cognitive stimulation program (3 sessions per week for 15-20 minutes) in addition to regular lessons. Upon completion, they recorded a significant increase in the results of the reading comprehension test, as well as an improvement in academic performance in language subjects compared to the control group without training [7]. This experiment demonstrated that training of cognitive functions (including tasks for memory, attention and logical thinking) is translated into specific academic achievements - children better learned the educational material on reading and their native language. P.O. Gladkova provides similar data on the correction of written speech: the inclusion of neuropsychological exercises in the program of speech therapy classes made it possible to reliably reduce the number of writing errors in younger schoolchildren with dysgraphia, thereby significantly improving writing skills. The presented results confirm that neuroexercises have a measurable developmental effect. Both narrow cognitive indicators (e.g. memory capacity, attention span, problem solving speed) and general educational indicators (academic performance, reading and writing quality) improve. It is important to emphasize that the positive effect is recorded both in typically developing children and in students with various learning difficulties. This indicates a broad potential for the use of neuropsychological methods in primary school. At the same time, the results demonstrate that the magnitude of the effect depends on the intensity and duration of the classes: a longer and more regular course of neuroexercises leads to more pronounced improvements. Therefore, for sustainable development of cognitive abilities, it is

necessary to systematically introduce neuroexercises into the educational process, rather than use them one-off.

**Discussion.** Analysis of modern sources allows us to answer affirmatively the question of whether neuro-exercises are an effective means of developing the cognitive sphere of primary school children. The totality of data indicates that with the correct organization of classes, neuro-gymnastics brings a multi-effect: voluntary attention, memory capacity, cognitive flexibility are simultaneously increased, and children become more motivated and involved in the educational process.

It is important to note that neuroexercises do not work in isolation, but are woven into the overall fabric of educational activities. As studies show, the greatest effect is achieved when neurotraining is integrated into the lesson structure. For example, 2-3 minutes of neuropsychological exercises at the beginning of a lesson or during a dynamic pause can "warm up" the child's brain, activate intellectual readiness to perceive new material. This confirms the concept that learning will be more effective if you alternate mental loads with short neurogymnastic warm-ups. At the same time, it is essential that such exercises are carried out systematically - only regular training leads to the formation of stable neural connections and long-term improvements in functions. One-time attempts, on the contrary, may not give a noticeable result.

Discussing the mechanism of action of neuroexercises, researchers agree that their effectiveness is associated with the phenomenon of neuroplasticity - the brain's ability to change under the influence of experience. At primary school age, the brain still has high plasticity, especially up to 10-11 years, when the frontal lobes and interhemispheric interactions are actively maturing. Neuroexercises, in fact, purposefully stimulate neuroplastic changes: they create new neural pathways, strengthen existing connections between areas of the brain responsible for sensorimotor skills and cognition. For example, the well-known "fist-edge-palm" exercise, which requires rapid changes in complex hand movements, involves the prefrontal zones

(control of the sequence of actions) and the cerebellum (coordination), which ultimately improves the overall ability to program and control activities. Such exercises have historically been used in neuropsychological correction of children with disabilities, but have now moved into mainstream school practice, demonstrating benefits for neurotypical students as well.

Another aspect discussed in the literature is the emotional-motivational effect. neuro-exercises . It is noted that the game and physical form of tasks evokes positive emotions in children and reduces academic stress. Enjoying the training process itself increases motivation for learning. Children who begin a lesson with fun neuro-gymnastics or play neuro-games from time to time continue to study the subject with more enthusiasm. Thus, neuro-exercises also perform an emotional-rehabilitation function, creating a situation of success for students, especially those who usually experience difficulties in learning. This confirms their complex influence: not only on "dry" cognitive indicators, but also on the psychological comfort and confidence of the child, which indirectly also improves cognitive productivity.

Despite the predominantly positive results, a number of authors point out the need for further research. For example, the issue of long-range transfer (to what extent trained skills are transferred to new non-standard tasks) remains debatable. Some reviews show that cognitive training provides reliable short-range transfer (improvement of trained functions), while generalization to general intelligence or academic performance is not always clear. However, the data we provided (for example, an increase in reading performance among participants in the cognitive program) indicate that with correctly selected tasks, transfer to academic skills does occur. Probably, the effectiveness of neuroexercises depends on the quality of methodological implementation: it is necessary to take into account the child's zone of proximal development, combine different types of exercises, and dose the load. Teacher training is also important - a teacher must understand the neuropsychological principles underlying the exercises in order to use them

correctly. In general, the discussion shows that neuroexercises are a promising direction, but they require methodologically competent application and further scientific support to reveal the full potential.

**Conclusion.** Analysis of scientific sources of recent years allows us to conclude that neuro-exercises are an effective means of developing the cognitive abilities of primary school students. Regular performance of specially selected sets of exercises leads to improved attention, memory, mental operations, and also contributes to an increase in children's academic performance. Neuro-exercises act through the activation of the brain's neuroplasticity : they form new neural connections, synchronize the work of the hemispheres and integrate sensorimotor and cognitive processes into a single system. An important advantage of neuro-exercises is their playful and entertaining form, which increases children's motivation and reduces fatigue, creating optimal conditions for learning. In practice, it has been proven that even short neuropsychological warm-ups in lessons can improve students' intellectual performance and the quality of material acquisition.

Thus, the introduction of neuro-exercises into the educational process of primary school seems to be a justified and promising step. It meets modern requirements for education, making learning more relevant to the capabilities and characteristics of the developing brain of a child. The neuro-pedagogical approach, based on the achievements of neuropsychology, allows not only to pull up lagging students, but also to reveal the potential of each child, to strengthen the foundation of their cognitive development. In the future, it is advisable to continue research in this area - in particular, to develop standardized neuro-training programs for schools, to study the optimal dosage and combination of exercises, as well as the long-term effect of such interventions. It is already obvious that neuro-exercises are becoming an integral part of the arsenal of a modern teacher and psychologist who strive to ensure the comprehensive development of primary school

students for the benefit of their successful learning and personal growth.

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