

# Innovations in Primary Education: Neuropsychological Aspect

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**Abstract:** *The article is devoted to the influence of neuropsychology on the modern student. The concepts of "neuropsychology" and "neuropsychological research", research and publications of domestic and foreign scientists on the development of neuropsychology and the use of methods that improve the work of the right and left hemispheres of the brain are considered in the article. The scientific potential of neuropsychology is indicated. Attention is drawn to the views of scientists who studied the neuropsychology of childhood. It has been found that there are many more books and periodicals in foreign literature that contain information on neuropsychology. A foreign project aimed at studying the brain is covered. It is emphasized that in modern educational institutions in Spain, teachers pay special attention to the neuropsychological characteristics of each child. Emphasis is placed on the difficulties of primary school children who need neuropsychological care. The focus is on the features of functional blocks of the brain and their mutual development. Emphasis is placed on the need to use health-preserving and play technologies in the organization of the educational process for teachers working on the Concept of the "New Ukrainian School". The effectiveness of kinesiological exercises for brain function, which contribute to the harmonious development of personality, has been proven. The significance of moving activities for the body of a child of primary school age is revealed. The powerful influence of means of musical and fine arts which help to develop visual perception, difficult spatial abilities, visual attention, memory, verbal and visual-motor skills on overcoming of neuropsychological frustration is proved. A block of neuropsychological exercises to activate the brain is presented. Samples of corrective exercises are highlighted: breathing exercises, massage, oculomotor exercises.*

**Keywords:** *neuropsychology, higher psychological functions, kinesiological exercises, junior high school student, game, art therapy.*

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## Introduction

According to the Concept "New Ukrainian School" now the priority in education should be personality-oriented learning, which aims to preserve the values of childhood, the need to humanize learning, personal approach, development of abilities of students, creating a modern educational environment that together provide psychological comfort and promote disclosure of children's creativity. Of course, the child's feelings and emotions play an important role in the learning process, and interest, self-confidence, job satisfaction are factors that increase motivation to learn. As known, a modern 6-year-old child gets tired quickly when doing monotonous work. In addition, every year in educational institutions there is an increase in children who need special and long-term psychological and pedagogical support, speech therapy.

Factors influencing the child's development include deteriorating socio-economic and environmental conditions, infections, alcohol and other harmful habits of parents, as well as an undifferentiated approach to learning, inflated educational requirements that outpace the pace of children's brain development.

Currently, NUS teachers are developing modern methods of teaching and working with children of primary school age. In addition, in their own experience, they feel the need in the importance to acquire knowledge exactly of neuropsychology, which will help teachers in the effective organization of educational activities.

It should be noted that neuropsychology is a separate branch of psychological science and practice, which began to take shape on the border of psychology, medicine (neurology and neurosurgery) and physiology. It has its own subject and specific tasks that are transformed and expanded during its development (Yatskiv, 2016).

As known, the founder of neuropsychology is a psychologist O. Luria, who worked in military hospitals, treated the wounded during World War II. Based on his own observations, the neuropsychologist identified new methods for studying disorders of higher mental functions in local brain lesions (Luria, 2018).

The term "higher mental functions" as a major factor in neuropsychology was introduced by L. Vygotsky. In addition, Lev Semenovich singled out the elementary mental functions, which, in his opinion, arise in society, on the basis of elementary congenital functions. Later, the psychologist asserted that elementary mental functions also

undergo qualitative changes in the process of social development (Vygotsky, 1956).

A neuropsychological examination is an examination of various mental processes (perception, attention, memory, speech, thinking, arbitrary movements and actions) followed by neuropsychological analysis of the data obtained. Neuropsychological analysis is the study of neuropsychological syndromes - regular combinations of disorders of mental functions in damage to various areas of the brain (Cirkina, 2004).

One of the sections of neuropsychology is childhood neuropsychology. It began its development in the 70-80's of the twentieth century thanks to O. Luria's student – E. Semerytska (Yatskiv, 2016).

Child neuropsychology - a field in neuropsychology that studies the relationship of social functioning (behavior and learning) of the child with the formation of his/her mental functions and personality, with the development of normal brain and pathology, as well as a direction that explores the possibilities of using the acquired knowledge for correctional and developmental learning (Glozman, 2009).

The Handbook of Clinical Child Neuropsychology, which provides best practices for elucidating the causes of brain disorders and their effects on the behavior, emotions, and personality of children and adolescents (Reynolds, 2000), deserves special attention.

### **Literature review: neuropsychological aspects**

An analysis of the literature that is dedicated to the concept of "neuropsychology" shows a large number of publications in regard with this research.

In the manual, neuropsychologist J. Glozman considers the concept of "thinking", analyzes in detail mental operations, offers a block of correctional and developmental exercises, advices, secrets for the development of thinking, memory improvement, attention, spatial imagery, speech, proves that children can be taught think independently and creatively (Glozman, 2010).

Dr. David A. Souze, an international consultant on neuropsychology, author of seven books published by Corwin Press, describes in detail the brain function of children with special needs, gifted children, separately analyzes the brain activity of the child during reading, mathematics. The most universal book is «The Brain of Leadership: Effective Strategies for Modern Schools», in which David A. Souza proposes a new model of a holistic approach to educational leadership. This powerful guide provides

information on understanding the differences in children's learning, characterizes the benefits of the right and left hemispheres, and proves that thinking plays an important role in solving problems and conflicts (David A. Sousa, 2015).

It is worth noting that the human brain is the most complex biological object (Akhutyana, 2008). There are currently 2 global brain research programs in the world: The EU-funded «Human Brain Project» involves hundreds of scientists from 135 institutes in 26 countries. This project aims to expand the capabilities of brain research to understand the human brain and its diseases to improve medicine and computing technology. It brings together neurologists, computer scientists and robotics engineers to create a unique infrastructure based on information and communication technology (ICT) for brain research. A similar «Brain Initiative» project was launched in the United States of America (USA, 2020).

An interesting strategy is Brain-Based Learning (BBL) (authors E. Jensen and D. Kane), i.e. "learning strategy based on brain knowledge". This technology is based on a number of recent discoveries made by neurophysiologists, neurologists, neuropsychologists over the past 20-30 years. According to scientists, it's possible to activate the brain when we take into account the following didactic principles:

- the teacher should remember that the brain can perform several activities, simultaneously perceive parts and the whole;
- information is stored in different parts of the brain and obtained in different ways;
- searching is the basis of brain activity;
- emotions affect memory and attention;
- intellectual development is improving when children interact.

These didactic principles set the basic requirements for the teacher: motivation; use of different teaching methods, effective use of time in class; feedback - teacher - student (Eric Jensen, 2020).

Luria O. proposed a block diagram of ideas about the relationship of brain functions, their arrangement on a hierarchical principle, their relationship with the structures of the brain. According to the proposed theory, the brain can be divided into three interrelated structural and functional blocks: block I - energetical (provides regulation of tone and vitality, so it acts as an accumulator of our behavior, satisfaction or dissatisfaction of needs - the activity of "I want". In case of damage to this unit, the child is weak, tired quickly, emotionally and physically exhausted); block II - informational (visual, auditory, spatial perception, tactile

sensations. In case of damage to this block, the child develops poor speech, subject (visual acuity), auditory and spatial perception - activities: "I can"; block III – regulatory (activates active conscious mental activity, forms plans and programs of actions, monitors their implementation and regulates behavior. These are attention, understanding of the instruction, maintenance of the task, control over activity, and estimation of results - activity: "I must"). Each block is characterized by its structure and the role it plays in the implementation of mental functions. Blocks are combined into so-called functional systems, which represent a complex dynamic, highly differentiated complex of chains located at different levels of the nervous system and involved in solving of various adaptive problems. O. Luria (1965) believed that functional systems do not appear ready for the birth of a child and do not mature on their own, but are formed in the process of communication and objective activities of the child and are the material substrate of mental functions.

Thus, the various components of arbitrary mental activity are carried out with the obligatory participation of all brain blocks. Dysfunction of any of the blocks is reflected in any mental activity, because it leads to a violation of its structure (Rodnenok, 2013; Melnyk, 2021; Komogorova, 2021; Melnyk, 2019; Maksymchuk, 2020a; Maksymchuk, 2020b).

In the best schools in Spain, educators are constantly acquainted with the latest research and development in the field of neuropsychology, as this is the basis that allows the use of innovative methods to improve the educational process and behavior of children. Teachers believe that in the organization of the educational environment the main factor is motivation in learning. In order to get children interested, to make them want to learn, teachers systematically organize work "in pairs", "in groups", diversify classes with interesting games. Educators believe that a child will feel capable and competent when he or she will be taught to control his or her own emotions (Spain, 2020).

It should be noted that the magazine "Children & Schools" contains articles in which the authors prove the opinion that the visual and musical arts have a powerful impact on the social and emotional state of children. During musical pauses, children perform rhythmic movements that increase brain activity (Tredinnick L., 2020).

Kinesiology - the science of brain development through movement. The founder of it in ancient Greece was considered to be Asclepiad, who lived more than 2000 years ago. Fundamental works of A. Luria prove the beneficial effects of hand manipulation on the functions of higher nervous activity and speech development. The neuropsychologist claims that both

hemispheres of the brain can develop effectively through the performance of special movements - kinesiological exercises (Luria, 1965).

It is known that the formation of a child's verbal language begins when the movements of the fingers reach sufficient accuracy. In addition, the lack of motor coordination of the wrist and fingers of a hand create difficulties in mastering reading and writing. V. Sukhomlinsky believed that the movement of the fingers promotes the activation of the speech centers of the brain and enhancement of activity of the speech zones. Thanks to "brain gymnastics", the organism coordinates the work of the right and left hemispheres, develops the interaction of body and intellect (Eisenbart, 2014).

A set of exercises developed by Paul E. and Gail E. Dennison in the 90's, is devoted to the natural development of man and the activation of certain mechanisms of the brain by means of certain movements. Practicing kinesiological exercises, the American psychologist realized that there is a huge potential in the movements. Classes according to the method of Dennison allow the one to develop balance, reading and writing skills, improve hearing, memory, reaction speed, optimize the learning process, and help cope with stress and anxiety, allow you to succeed in learning, music and sports. And most importantly - children begin to enjoy the learning process (Dennison Paul, 1998)

Scott Cuthbert used kinesiology to treat a 10-year-old boy with developmental delay, asthma, and chronic neck and head pain. After a long time, the child's ability to read improved, neck and head pain disappeared (Scott Cuthbert, 2010).

There is ample evidence that art therapy is associated with different children's neuropsychological abilities. The American Academy of Clinical Neuropsychology of Child Neuropsychology sees the overcoming of neuropsychological disorders by means of drawing, which helps to develop visual perception, complex spatial abilities, visual attention, memory, verbal and visual-motor skills (Reynolds, 1989).

Noteworthy is the article (Vincenzo, 2020) on the beneficial effects of drawing for the development of neuropsychological abilities in children: visual perception, visual-motor coordination and verbal abilities.

### **Use of health-saving and game technologies by teachers who are working according to the Concept of "new Ukrainian school"**

The concept of "New Ukrainian School" proposed new principles of learning: inclusion, non-discrimination, partnership, humanism and creative approach to learning, child-centeredness, which take into account child's

abilities, needs and interests, age characteristics of physical, mental and intellectual development as much as possible.

The main place among pedagogical technologies in the educational process is occupied by game and health-saving technologies.

### **Game technologies**

Game technologies are one of the unique forms of learning that allow making the process of subjects studying interesting and exciting, activate attention, and increase interest in learning, force younger students to perform mental actions independently to achieve success, because there is a thought process that requires sufficient brain activity.

V. Sukhomlinsky wrote: "The game is a huge bright window through which the life-giving stream of ideas, concepts about the world around flows into the spiritual world of the child. The game is a spark that lights the fire of curiosity" (Eisenbart, 2014, p.2).

Carl Gross proved that game is important for a child's development, because it provides an opportunity to improve coherent speech (jointly solving game tasks, children learn to communicate with each other), develop cognitive processes (stimulates the child to achieve the goal, and find the way to achieve the goal), to feel the "situation of success" ("situation of success" provides emotional satisfaction, and failure is not perceived as defeat). (Groos, 2018).

### **Health-saving technologies**

Kinesiological exercises. The level of speech development of children is directly dependent on the degree of formation of movements. A person, who moves harmoniously and energetically, has excellent coordination, will have better developed logical processes; will be concentrating easier. Modern kinesiologists believe that learning problems often arise due to the lack of integration of the right and left hemispheres of the brain. Therefore, it is through movement that a child can find this balance, feel his or her own body and space, and even be aware of temporal ideas when it comes to rhythm. Thus, kinesiology is a health-preserving technology that helps children to relieve emotional and physical stress, and at the same time can provide the following processes:

- synchronization of the hemispheres of the brain;
- visual and motor coordination improvement;
- formation of spatial orientation;
- stimulation of intellectual development, etc.

Kinesiological exercises have a positive effect on the neocortex - the cerebral cortex, which is responsible for cognitive processes, rational information processing, language, logic and more. After all, when the newly formed cerebral cortex is working at full capacity, the effectiveness of training increases.

### **Visualization exercises. "Ear-nose"**

With the left hand we take the tip of the nose, and with the right - for the opposite ear. Simultaneously release the ear and nose, clap your hands and change the position of the hands so that the right is held by the tip of the nose, and the left - by the opposite ear.

### **"Ring"**

Alternately and very quickly move the fingers, combining index finger, middle finger, ring finger, and pinky finger in the ring with the thumb. At first it is possible with each hand separately, then simultaneously with two hands.

### **"Fist - edge of the palm - palm"**

The child is shown three positions of the hand on the plane of the table, successively changing each other ("Fist - edge of the palm - palm"), pronounced aloud or to oneself.

Moving activities. Moving activities – such breaks during the lesson help to improve the functioning of the brain, restore tone of the muscles that maintain proper posture, relieve tension from the organs of sight and hearing, from fingers that are tired from writing. These exercises are necessary to maintain the health of students to lift their spirits, increase blood and lymph metabolism of stagnant areas in the child's body, and relieve static tension (Nosko, 2018).

### **Moving activity "Firewood cutting"**

- Children, we sat a lot, so we will try to have an active rest, we will "cut firewood". Stay so as not to disturb anyone. Imagine that you are cutting firewood. To show how big the log is in front of us. Put it on a stump and raise the "ax" high above your head. Every time you lower the "ax", shout out loud: "Heh!". In a minute tell: how many logs are "cut"? - How do you feel now? How is your mood?

**Neuropsychological exercises to activate the work and functional block of the brain (level of stabilization, activation and energy supply of psychomotor skills and speech).**

Complexes of exercises, which are focused on the optimization of the 1st functional block of the brain, can be included in the organizational moment of the lesson or the preparatory part of the lesson. The targets of correction are the subcortical and stem formations of the brain. To implement the corrective effect should be used:

### **I. Breathing exercises**

Purpose: optimization of gas exchange and blood circulation, calming, development of concentration, self-control over behavior.

#### **"Positive setting"**

Put two fingers together on both hands. Put on the bumps on the forehead, just above the middle, on the line between the eyebrows and the hairline. This helps to increase blood circulation, activation of the frontal lobes of the brain.

### **II. Massage, self-massage (scalp, fingers and auricles, nose). "Cap for thinking"**

Gently pull back and press your auricles with your thumb and forefinger while massaging it. Keep the thumb on the back side of the ear, the index finger - on the front side. Massage should start from the top and go down, along the "folded" areas of the auricle to the lobes. It is important to keep your head straight. Repeat the exercise 3-4 times. Blood circulation increases in the temporal areas. It helps short-term memory work, improves balance, allows you to concentrate.

### **III. Oculomotor exercises**

Purpose: spreading the field of view, visual perception, tracking the object with the eyes at different levels and in different directions: right, left, up, down, to the nose, from the nose, the elimination of synkinesis.

#### **"Drawing with two hands"**

The purpose of this exercise is to adjust the hemispheres of the brain to a harmonious, coordinated cooperation by means of simultaneous creation of a drawing and of stroking lines with both hands. The child takes a pencil in each hand and, following dotted lines, simultaneously draws a picture with both hands. After drawing the contours, the picture should be painted with both hands. This unique drawing technique will promote better memorization, concentration, and quick analysis of information, active thinking, and development of mental and intellectual abilities.

### **"Reaching for the sun"**

Rise up on your toes, reach for the sun, and get down on your heels. Step vigorously on the floor with your heels while standing still. Exercise helps to relieve stress, to feel support.

### **Neuropsychological exercises for the activation of the II functional block of the brain**

Complexes of exercises that focused on optimization of the second functional block of the brain can be used throughout the lesson. They affect the analytical system; allow the development of somatognosis, tactile, visual and auditory gnosis, spatial imagery and speech.

An important task of correctional work with younger students who have disorders is the restoration of gnostic and plastic functions. Didactic games with elements of distinction by ear of "loud-quiet", "fast-slow", musical fragments with different rhythmic and emotional structure contribute to the development of phonetic-phonemic level. An effective training here is a hide-and-seek game, which can be diversified with the full range of sounds. The next most important task is the formation of phonematic hearing, because there is no and cannot be a type of mental activity that would not be directly dependent on the formation of this psychological factor. There are many exercises that have repeatedly proven their necessity in the domestic defectology and neuropsychology for the process of implementation of the formation of non-speech and then speech sound distinction.

You can highlight the sound by strokes, stomping, any movement, raising the color flag, etc., switch attention from one sound to another by changing the basic movements, with opened and closed eyes.

### **"Circle and paint" (development of fine motor skills of hands)**

Children are asked to draw image on the dots and paint it. When painting, it is necessary to move fingers and wrist but not the whole hand with the shoulder.

### **"Unusual traces" (development of tactile sensitivity)**

"Teddy bears are going" - the child presses his or her fists and palms with force on the sand.

"Hares are jumping" - the child's fingertips hit the surface of the sand, moving in different directions.

"Snakes crawl" - the child with relaxed / tense fingers makes the surface of the sand wavy (in different directions).

"Spider-beetles are running" - the child moves all fingers, imitating the movement of insects (they can completely immerse their hands in the sand, meeting their hands with each other under the sand - "beetles are welcoming one another").

### **Neuropsychological exercises to activate the work of the III functional block of the brain**

All tasks must have clear rules, execution algorithms and methods of evaluation. It is formed in several stages:

- Joint performance of the task ("Do as you want");
- Verbal control, clear instructions for execution ("Do exactly that");
- Verbal control by the child ("Throw the ball up");
- Talking to oneself, automation of actions.

#### **"Earth-fire-water"**

The participants of the game form a circle. The facilitator is in the center. The facilitator exclaims one of the four words: "earth", "water", "fire", and "air". If the facilitator says "ground" - the children should quickly take the position of squatting; "water" - "swim"; "air" - raise hands up and imitate the wind. If the facilitator shouts "fire" - all participants of the game must quickly return around.

Exercises of neuropsychology are universal. They help both adults and children. Being very easy to perform, they do not require special physical training. Regular performance of these exercises relieves fatigue, increases concentration, increases physical and mental activity, and stimulates speech processes. They help children to concentrate, coordinate their activities, get rid of stress, overcome various defects; make correctional classes fun and interesting.

Neuropsychological correction is aimed at stimulation of development and formation of concordant, coordinated activity of various brain structures. With the help of specially designed motor exercises and developmental games the formation of certain components of mental activity is stimulated, namely: regulation and control of mental activity, motor skills, visual, auditory, spatial perception and many others.

It should also be noted that the energetic potential of the brain increases if it can receive information from different analyzers. Of course, learning is effective when the child uses different channels when perceiving new material: visual, auditory, tactile, olfactory, aesthetic, and so on. For

example, if we want to learn something complex, we intuitively get up, can walk around the room or sit comfortably, and then read the text out aloud, take notes or draw icons on its content, trying to imagine a picture related to what has been learned.

The brain needs a significant amount of energy that a child can get from proper nutrition, appropriate drinking regime, good sleep, balanced cardiovascular system and more. Child's ability to memorize, hold arbitrary attention, thinking, and perception depends on these exact higher mental functions.

It is known that brain activity is affected by the temperature in the room. If the children returned from a break and sat in a ventilated room, it gives them liveliness and stimulates the brain to work. When it's cold in the classroom, the body tries to conserve energy to keep warm. Then the child becomes passive: he or she wants not to think, not to move, and there is a desire to sleep.

Thus, the development potential of innovative methods is very high, because in their complex they affect thinking, attention, memory, imagination, perception. It should be noted that when a student joins the implementation of joint projects, group tasks performance, he feels an active creator of his own experience, rather than a passive observer. Awareness of the individual that he or she is important to others increases his or her energy level.

## **Conclusions**

So, today knowledge of neuropsychology is extremely necessary for primary school teachers in NUS in Ukraine, because teachers are concerned about the following factors: the number of children with memorization difficulties has increased as well as the number of children who find it difficult to understand the explanation of the material from the first time; the child cannot cope with the task of individual work; the student is distracted at lessons, climbs under a desk, plays, eats; the child leaves during the lesson and does not return for a long time; the student is constantly late for lessons; after the lesson it turns out that the child has no written work; does homework perfectly, but cannot cope with the task at school, etc. Such difficulties in the acquisition of knowledge can occur due to the immaturity of some parts of the brain that are responsible for motor functions of the hands, language attention, visual and spatial orientation.

All of the above methods claim that the use of health-saving and playful technologies in NUS allow to make learning interesting, exciting, and, most importantly, to keep the child healthy.

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