

Innovative Educational Environment in the Conditions of Educational Reform: Neuropsychological Approach

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Abstract: *The article is devoted to the neuropsychological approach to the organization of an innovative environment in the context of education reform. Attention is focused on the fact that now pedagogical workers note an increase in the number of children who have learning difficulties and behavior problems. The concepts of "neuropsychology" and "child neuropsychology" are considered. Focused on leading figures of domestic and foreign neuropsychology. Manuals and articles of domestic and foreign scientists on the relevance of the neuropsychological aspect in school practice are covered. The main tasks of neuropsychology are determined. It has been found that in the foreign literature there are many modern publications on the concept of "school neuropsychology", which provide many different corrective exercises, which are addressed to teachers, psychologists, neuropsychologists, speech therapists in working with children. It is emphasized that the psychomotor development of the child is manifested in his speech, gestures, writing, emotional state. The following pattern has been noted: in order for children to learn better, they need to move more. It is emphasized that modern teachers desperately need knowledge of neuropsychology to succeed in working with today's children. The significance of the use of neuropsychological techniques in the educational process is revealed. The focus is on speech skills, which are closely related to fine motor skills. Kinesiology exercises have been shown to play an important role in the functioning of the right and left hemispheres of the brain. Examples of moving exercises that improve the functioning of the child's brain are given.*

Keywords: *neuropsychology, school neuropsychology, higher mental functions, kinesiology, sensorimotor correction, finger gymnastics.*

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Introduction

Today, educators, neuropsychologists, researchers and experts in the field of psychology and neuropedagogy note that today more and more school-age children have learning difficulties. Students have difficulty remembering and reproducing information from memory, concentration, application of acquired knowledge, skills and abilities, etc.. In addition, students have problems with coordination, a sense of balance, lack of sense of rhythm, decreased visual-motor coordination, concentration. As a result, children spend more time on gadgets, avoid moving games, because it is difficult for them to catch the ball, to hit the target; it is difficult for schoolchildren to jump, run, etc. There are various reasons for these difficulties. Among them, the main, scientists determine - neuromotor immaturity.

The article aims 1) to prove that primary school teachers of the New Ukrainian School must have sufficient neuropsychological knowledge to work with students; 2) to analyze relevant scientific literature on the theory and practice of school neuropsychology.

Neuropsychology is a branch of psychological science that emerged on the basis of knowledge about psychology, medicine and physiology, studying the brain mechanisms of mental processes based on local brain damage (Yatskiv, 2016). This science arose due to the research by Luria (2018), who in his work developed a single line of research - from ideas about the brain organization of individual mental functions - to general ideas about the principles of localization of any mental processes and the brain as a whole.

Neuropsychology as an independent branch of science focused on the study of the role of individual brain systems in the implementation of mental activity.

A significant contribution to this industry in the 80's of last century was made by Simernytska (1997). The neuropsychologist argued that for children under 10 years of age, in contrast to adults, damage to the right hemisphere of the brain is extremely significant, because it leads to impaired higher mental functions. Based on this, it was concluded that in children the brain organization of higher mental functions is different than in adults. Of fundamental importance is that higher mental functions and their brain organization change with age. This, on the one hand, complicates the diagnosis of disorders, and on the other hand, provides a high compensatory potential in childhood. Neuropsychological studies of children reveal the chronological sequence of maturation of higher mental processes.

It is known that the study of the brain as an organ of mental activity in recent years occupies one of the main places in the research of scientists around the world: neuropsychologists, psychologists, physiologists, speech therapists and other scientists. Vygotsky (1956) wrote about the extreme importance of the development of higher mental processes. It is obvious that brain damage can lead to aggravated consequences for violations of higher mental functions: speech, thinking, memory, perception, imagination, attention.

It should be noted that the most intensive development of higher mental functions occurs in childhood, when the foundation of physical and mental health is formed, and this will largely depend on its future. Therefore, it is very important to notice violations in the early stages of a child's development and to improve the child's health with the help of corrective exercises (Astapov, 2019; Komogorova et al., 2021; Maksymchuk et al., 2020a; Melnyk et al., 2021; Palamarchuk et al., 2020).

Neuropsychology is a fundamental science of the brain, respectively, has become a priority in education, because it helps teachers to solve problems in terms of corrective diagnosis and psychological and pedagogical rehabilitation: explains the patterns of psychomotor, cognitive and emotional development of the child (Gerasymova et al., 2019; Onishchuk et al., 2020; Maksymchuk et al., 2020b; Shevtsov, 2007).

The main tasks of neuropsychology are:

1. To study changes in mental processes in local brain lesions, which allow us to see with which brain substrate is associated with a particular type of mental activity.
2. Neuropsychological analysis makes it possible to identify those common structures that exist in completely different mental processes.
3. Early diagnosis of brain lesions (Repin et al., 2003).

Child neuropsychology is a branch of psychological science on the formation of brain activity of mental processes. Nowadays it is becoming more and more popular as a method of syndromic psychological analysis of mental activity deficit in children associated with one or another brain insufficiency (organic or functional) or immaturity (Semenovych, 2002).

School neuropsychology requires the integration of neuropsychological and educational principles into assessment and intervention processes with children and adolescents to facilitate learning and behavior in school (Miller, 2007).

The scientific value of the article lies in proving that child rehabilitation neuropsychology has allowed one to update the understanding

of various forms of disorders in the mental development of children and outline new ways to compensate for them.

Review of the literature of domestic and foreign scientists on the study of aspects of school neuropsychology

Analysis of the literature on the review of the concept of "neuropsychology" indicates a large number of publications on this study.

Many Ukrainian (Khomskaya, 2005; Luria, 2018; Simernytska, 1997; Vygotsky, 1956; Yatskiv, 2016) and foreign (Baron, 2018; Connor, 2014; D'Amato et al., 2010; Miller et al., 2019) researchers have studied the impact of neuropsychological processes on humans.

On the theoretical foundations and practical application of neuropsychology describes in detail (Khomskaya, 2005). The author presents the theory of systemic dynamic localization of higher mental functions, considers the basic principles of the brain. In addition, it focuses on the neuropsychological analysis of disorders of higher mental functions in local brain lesions: memory, thinking, imagination, attention, speech. In her work she thoroughly analyzes the violations that arise in the emotional and personal sphere. In addition, the scientist has developed developmental and psycho-correctional programs.

Connor (2014), a professor at the University of Notre Dame in Maryland, studied emotional disorders in school-age children from a neuropsychological and pedagogical perspective. The author conducted a detailed analysis of neurobiological correlators of mood disorders and identified the causes of anxiety, psychopathology in children. The scientist claims that it is possible to improve the emotional well-being of schoolchildren through the use of modern learning strategies, taking into account the emotional, psychological and social needs of the child.

Noteworthy is the manual in which Baron (2018) gives a neuropsychological assessment of the child, demonstrating the state of the brain from preschool to adolescence. The collection presents the consequences that may occur in the case of the spread of rare medical diseases and psychological disorders. To help teachers and psychologists, there are domains and tests that will help educators determine the level of thinking, imagination, memory, attention, speech.

A current view of neuropsychological practice in educational institutions is given in the manual (Miller et al., 2019), which emphasizes the need to test students in order to plan effective work of psychologists in a timely manner. The book provides advice on how to choose the right

assessment tools, effectively diagnose, accurately interpret the results of the study.

Comprehensive information on the theory and practice of school neuropsychology is provided by D'Amato et al. (2010). Because new research reveals disorders that were previously thought to be behavioral or functional, child neuropsychology is now an important, much-needed discipline for identifying and overcoming childhood and adolescent disorders. The handbook on school neuropsychology contains knowledge about neuroanatomy, practical rationale for various children's neuropsychological problems.

It is worth noting the manual by Hale & Fiorello (2004) in which they present the latest research on the relationship between the brain and the behavior of the child, offers a variety of neuropsychological techniques for use in working with students. The author comments on previous ideas about brain functions and presents a model for testing cognitive hypotheses as an innovative method that helps psychologists identify the characteristics of students and conduct individual work with children who have learning difficulties and behavioral disorders.

Thus, the above-mentioned manuals and articles show that neuropsychology has come a long way in its development as a science and is indeed relevant today. Researchers continue studying disorders in higher mental processes and offer effective strategies to improve the child's ability to manage emotions.

The use of neuropsychological techniques in the educational environment

In modern conditions, children often have problems adapting to school. Given that children go to school at the age of six, many of them are not ready for mental and physical exertion. Every year the requirements of the school program become higher. Children behave badly, refuse to go to school, get tired quickly. Parents often ignore the problem, believing that over time it will pass by itself. At the same time, the child suffers himself and torments his parents, who consider him disobedient and uncontrollable. In addition, failure leads to various psychological problems. There are fear, anxiety, self-doubt, feelings of "looser", difficulties in communicating with classmates.

Psychomotor development is the basis for the mental development of the child, because it is manifested in a variety of manifestations of human activity: speech, gestures, writing, emotional expression, locomotor movements, instrumental motor actions.

An essential feature of "post-Luria" neuropsychology, especially experimental, is the detailed development of restorative techniques in its "rehabilitation" direction. In the field of child neuropsychology, this was reflected in the creation of methods of correctional and rehabilitation type, one of the most striking examples of which is the creation of a "method of replacement ontogenesis" (Semenovych, 2002). The theory of this method not only provided a neuropsychological scientific basis for well-known in defectology existing methods of correction of children's development, but also gave impetus to the creation of new original approaches in this area of work with children with learning difficulties. In addition to achieving diagnostic and analytical goals, neuropsychological approaches in correctional pedagogy ("neuropsychological" approaches) provide opportunities to create recommendations for correcting certain developmental defects (speech, psychomotor, cognitive processes, visual perception, control over their own behavior, emotional disorders, etc.). Child rehabilitation neuropsychology has made it possible to modernize the understanding of various forms of anomalies in the mental development of children and to outline new ways to compensate for defects. Neuropsychological techniques in pedagogy should be successful in correcting the child's development, because the developing psyche and brain are unusually plastic and ready for the development of basal (basic) neuropsychological factors that are the supporting components for further improvement of cognitive and emotional processes. In the future, a complex multi-level structure of a person's individuality is built and supported on them. In this case, the group of basal factors includes: modal-specific; kinesthetic; kinetic; spatial; arbitrary regulation of mental activity; energy supply; interhemispheric interaction, etc. (Shevtsov, 2007).

The presence of the relationship between intellectual, social, speech development and motor activity, the state of health of the child determines the feasibility of using such approaches that provide a comprehensive impact on the child's personality. The unique role of physical and speech development determines the need for their integration for the overall development of the child. The purpose of integrated speech-motor joint motor activity is to ensure the relationship between motor activity and speech development of children (Panhelova & Krutsevych, 2019).

Jensen & McConchie (2020) emphasize in their book that the better a teacher knows about his students' brains, the easier it will be for him to work with them. Teaching subjects, taking into account the characteristics of children and knowledge of neuropsychology, help the teacher to strengthen the cognitive functioning of the brain, reduce problems with discipline in

children, improve their level of learning, create a situation of success. Jensen & McConchie (2020) tell how to provide a modern approach to learning: a broad understanding of the impact of relationships, feelings, movements and emotions on learning, presents modern strategies for creating high quality educational environments together with self-service strategies; teaching aids to motivate children to help them feel the joy of learning. Thanks to this manual, you can thoroughly learn about the work of the child's brain, why it is unique, the power of learning the brain, the relationship between physical movement and the brain, the influence of feelings on learning, classroom relationships between children, how emotions affect learning, how to make the brain works.

Jensen (2009) provides ideas for educators to ensure that every child can succeed in learning. The teacher emphasizes that, as we know, different students have their own individual characteristics. But it happens that children are stressed, injured or suffer from developmental delays, then teachers must be able to understand the symptoms of the child's disease, make adjustments to the education of students. This full-color guide has been updated and packed with powerful techniques and strategies to help educators improve brain function in children, and contains an algorithm for detecting disorders such as attention disorders, memory disorders, dyslexia, depression, auditory attention deficit, and more. Such systematic work of the teacher will help children to effectively overcome learning difficulties, meet the specific educational needs of children with special needs.

University of Texas professor Miller (2012) in his handbook on practical school neuropsychology provides articles on school neuropsychology in which best practice teachers provide advice on teaching children of artists with Asperger's disorder, developmental delay, hearing loss, children with visual impairments etc. Separately, the author posted articles that offer methods and forms of work with children who have difficulty reading, writing, math.

Sensorimotor correction is a set of general developmental exercises that help to develop brain functions. Exercises help students to concentrate, be collected, facilitate memorization, improve overall body tone. In addition, the exercises can be used during a break to relax.

Kinesiology - the science of the brain through the action of movements. It is known that scientists claim that interhemispheric interaction develops through a set of kinesiological exercises. Given the functional specialization of the hemispheres (right - humanitarian, figurative; left - mathematical, symbolic), as well as the role of joint activities in the implementation of higher mental functions, we can assume that the violation

of interhemispheric transmission of information distorts children's cognitive activity. Of course, if the conduction through the corpus callosum is disturbed, the conductive hemisphere takes on a large load, and the other is blocked. Both hemispheres begin to work without communication. Spatial orientation, adequate emotional response, coordination of visual and audio perception with the work of the writing hand are disturbed. A child in this state cannot read or write, perceiving information by ear or eyes. Much of the cortex of the human cerebral hemispheres is occupied by cells associated with the activity of the hand, especially the thumb, which in humans is opposed to the rest of the fingers. The main development of interhemispheric connections is formed in girls up to 7 years, in boys - up to 8 - 8.5 years.

Improving intellectual and mental processes must begin with the development of finger and body movements. Developmental work should be directed from movements to thinking, and not vice versa. The corpus callosum can be developed through kinesiological exercises. Under the influence of kinesiological training of interhemispheric interaction, the unity of the brain is formed in relation to the activity of its two hemispheres, closely connected by a system of nerve fibers (corpus callosum, interhemispheric ligaments). It has been proven that for children to learn better, they need to move more. Speech skills are associated with fine motor skills of the fingers: if a person binds his fingers, he will learn ten times slower. In addition, modern teaching methods show that new information is easier to understand and remember by influencing different channels of perception: sight, hearing, tactile sensations, taste, touch and movement. Speech is the result of coordinated activity of many areas of the brain. The articulatory organs only carry out orders coming from the brain. The projection of the hand in the brain is located very close to the speech motor area. The relationship between motor and speech zones is manifested in the fact that a person who hesitates to choose the appropriate word, helps himself with gestures, and vice versa: focused drawing or writing, the child involuntarily sticks out his tongue. Because there is a close relationship and interdependence of speech and motor activity, in the presence of a speech defect in a child, special attention is paid to the development of small movements of the fingers, which has a positive effect on the functioning of the speech areas of the cerebral cortex. Kinesiology stimulates the intellectual development and motility of the child.

When children were stressed or inactive throughout the day, their ability to learn disappeared (Elder, 2017). If parts of a child's brain become inactive, how can they learn? When he began to integrate education and

kinesiology or to teach through movement, he noticed that the child's brain became active in learning. Each lesson should be performed at the pace of the child and take as much time as the child needs.

Exercise 1

Let the child stand up straight and raise his left knee. Ask her to put her right hand on her left knee, crossing the midline of her body. With your right hand on your left knee, ask your child to move, raising his right knee and placing his left hand on his right knee. Movements should be done slowly and carefully. Sometimes children do these exercises too quickly, but they should not be done. Continue to exercise at least 10 times, at least three days a week (Elder, 2017).

Exercise "Elephant"

Exercise activates and balances the whole system of the body "intelligence-body", improves concentration. Press the ear tightly to the shoulder. At the same time, extend one hand like an elephant's trunk and start drawing a horizontal figure eight from it, starting from the center of the field of view and going up counterclockwise. The eyes follow the movements of the fingertips. Then change hands. Perform the exercise slowly, 3-5 times with each hand.

Exercise "Palm"

This exercise improves mental activity, synchronizes the work of the hemispheres, promotes memory, increases the stability of attention, activates the processes of writing and reading. Three positions of the hand, successively changing:

- 1) Squeeze your palms into a fist
- 2) Put your palm on the edge.
- 3) Straighten your palm on the plane of the table.

The exercise is performed first with the right hand, then with the left hand, then with both hands together. Repeat 8-10 times.

Exercise "Mirror drawing"

The exercise is performed either on a board or on a blank sheet of paper. You need to take a pencil (chalk) in both hands. Start drawing mirror-symmetrical drawings, letters, numbers with both hands at the same time. When performing this exercise, the eyes and hands relax. When the activity of both hemispheres of the brain is synchronized, the efficiency of the whole brain will increase significantly. Exercise helps to synchronize the work of the hemispheres, the perception of information, improves memory (Lichman, 2019).

The buttons on the brain are designed to stimulate blood flow to the brain and activate the reticular activation system, which is the child's internal

alarm clock, which tells the brain that it must be effective for learning. Its purpose is to awaken the child and help him stay alert, especially if it is lethargic, cranky or prone to low energy or problems with attention and concentration.

Finger gymnastics is a game exercise for the development of fine motor skills. Scientists have proven that finger gymnastics in combination with breathing improves and trains the insufficiently trained part of our body - the brain. The brain controls all our actions, because it is directly connected to the fingertips. Performing finger exercises improves thinking and speech, develops creativity, involuntary attention, memory, sense of rhythm, develops self-control skills, regulates emotions and relieves stress.

Exercise 3

Take a minute and raise your arms perpendicular to your face. And now bring them a few inches to the nose. Focus on the center where your hands meet. Think about what you see. You may feel heat on your fingertips and palms. Perhaps some air from the fan or window flows through the smallest gap on the palms or through the gaps between the fingers (McKinsley, 2019).

"River and fish"

The river is a wavy, smooth movement of relaxed hands.

Fish. Starting position: straightened palms pressed together. Fingers pointing away from you. Rotate the closed palms to the right and left, imitating the movements of the fish's tail.

Our little fish is wagging its tail,
This pretty girl lives in the river.

"Sitting squirrel"

The squirrel sits, teaches nursery rhymes,
She sells nuts:
Fox-sister,
Sparrows, little tits,
Teddy bear,
Whiskered hares.

(with the help of the left hand bend the fingers of the right hand, starting with the thumb)

"Friendship"

Girls and boys are friends in our group
(fingers are connected in a "lock").

We will make friends with you little fingers
(rhythmic touching of the fingers of the same name by both hands).

One, two, three, four, five

(alternately touching the fingers of the same name, starting with the little fingers),
Start counting again.

One, two, three, four, five (*Hands down, shake your arms*).

We finished counting (Voronets, 2020).

So, kinesiological exercises and finger gymnastics in working with children of primary school age should be used systematically, from simple to complex. Practicing finger movements stimulates the development of speech in children. In addition, finger gymnastics develops the child's ability to repeat, listen, concentrate, develops memory, fantasy, imagination.

Kinesiological exercises provide an opportunity to develop the child's mental abilities and improve physical condition. Regular performance of these exercises relieves fatigue in children, improves memory, concentration, there is significant progress in the ability to learn and the ability to manage of emotions.

Therefore, neuropsychological knowledge helps teachers of the New Ukrainian School use the latest methods to ensure the connection between intellectual, social, speech development and motor activity since it largely affects the health of the child.

Conclusions

As the analysis of the study shows, today you can find many publications, manuals, which tell about the application of neuropsychology in school practice.

The scientific value of the article lies in proving that child rehabilitation neuropsychology has allowed one to update the understanding of various forms of disorders in the mental development of children and outline new ways to compensate for them.

As you know, a modern teacher in the context of educational reform must understand the latest trends in education, have innovative methodological approaches, be able to interest the child in the material, awaken and retain attention, focus on objects, environmental phenomena and their own observations.

Undoubtedly, the integration of neuropsychological and educational principles helps the teacher to organize effective learning, which contributes to the productive acquisition of new knowledge, successful personal development of the child, which is the key to quality primary education.

Thus, to improve the development of higher mental functions of the child, the use of various neuropsychological techniques is of great benefit. Their use is very important.

In particular, kinesiological exercises, finger gymnastics stimulate the intellectual development of the child: improve mental activity, synchronize the work of the hemispheres, help improve memory, increase the stability of attention, facilitate the writing process.

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