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Neuropsychological Bases of Correctional and Preventive Preparation of Children with Autism to Master Writing

Zoriana LENIV[1],
Oksana DZHUS[2],
Nataliia ILINA[3],
Olesia PROKOFIEVA[4],
Nataliia MATVEIEVA[5],
Iryna HLUSHCHENKO[6]

[1] Vasyl Stefanyk Precarpathian National University, Ukraine, lzoryana@ukr.net
[2] Vasyl Stefanyk Precarpathian National University, Ukraine, oksana.dzhus@pnu.edu.ua
[3] Kherson State University, Ukraine, asha@ksu.ks.ua
[4] Bogdan Khmelnitsky Melitopol State Pedagogical University, Ukraine, prok.olesya@gmail.com
[5] Vasyl Stefanyk Precarpathian University, Ukraine, nataliematveieva@gmail.com
[6] Communnal Higher Educational Establishment "Kherson Academy of Continuing Education" of the Kherson Regional Council, Ukraine, glushchenko.irina19@gmail.com

Abstract: *The article presents a neuropsychological approach to the correctional and preventive preparation of autistic children to master writing. The neuropsychological bases of correctional work with autistic children are considered: structural functional organization of the brain and symptoms of the main disorders of brain blocks, scientific ideas about functional blocks – regulation of the level of brain activity (energy block); receiving, processing and information storing block; block for programming, regulation of educational activities, including writing and its control. Scientific ideas about autism, learning difficulties and methods of writing development in children with developmental disabilities are analysed. Neuropsychological recommendations for correctional and preventive preparation of autistic children to master writing based on domestic and foreign experience have been developed. It is confirmed that implementation of correctional and preventive training of autistic children in writing should be carried out mainly individually, comprehensively and systematically, taking into account disorders in the mental development of a child and the prognosis of learning difficulties. The conceptual provisions of neuropsychology about the brain organization of higher mental functions and functional blocks of the brain, features of interfunctional systems, methods of correctional and preventive, restorative training of special children in writing and the method of "substitutive ontogenesis" are reflected.*

Keywords: *Higher mental functions, social interaction, inclusive education, neuropsychological methods, neuropsychological factors, neuropsychological exercises, neuropsychological recommendations.*

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Introduction

The problem of studying technologies of correctional and preventive education of children with autistic writing disorders is increasingly attracting attention of neuropsychologists, clinical psychologists, neurophysiologists. According to ICD-10 scientific data, in particular neuropsychology, autism has a phenomenological variability – a wide range of autistic disorders of both endogenous and exogenous psychopathology with disorders of mainly social interaction, communication and behavior. In this regard, selection of adequate neuropsychological correctional and preventive methods of teaching special children in writing should include: diagnosis of cognitive abilities of primary school children, taking into account the type of autism (specifics of autistic disorders), specifics of mental development and age category; prediction and forecast of possible learning outcomes and selection of adequate methods of teaching special children in writing, taking into account peculiarities of the child's speech development; formation of psychological readiness and motivation for social interaction in communication with the environment in autistic children (Demchenko et al., 2021; Melnyk et al., 2019; Melnyk et al., 2021; Sheremet, 2019).

Undoubtedly, deviations from the norm in the mental and speech development of children with disabilities cause difficulties in learning to write. Importantly, in autistic children, the speech regions of the brain and speech apparatus in the vast majority of cases are functional. The ability to express ideas in a few words, the ability to memorize letters is already a criterion for success in mastering writing. However, autistic children are not active in communicating with others. The main thing is tolerance and responsibility of teachers in partner motivation of special children for communication and their competence in creative application of neuropsychological methods in preparing autistic children for writing. Understanding the impact of neuropsychological mechanisms of the brain on the effectiveness of education of special children enables selection of adequate correctional and preventive methods of mastering writing, which is one of the current problems of inclusive education.

Theoretical neuropsychological framework of research of introduction of correctional and preventive methods of preparation of children with autism for mastering of writing: foreign and domestic experience

The term "autism" from the Greek "autos" means oneself, which characterizes a child with a tendency to alienation from reality, a unique

inner life, a special world of dreams and fantasies. At the level of popular psychology, autistic children are called indigo and are identified with the phenomena of solitude. The mental organization of children with autism has really unique features of a person who is immersed in one's inner world due to specific mechanisms of psychological protection and inconsistent contact with the external environment, receiving certain pieces of information. The number, ambiguity and variability of autistic symptoms, the lack of differentiated understanding of its neuropsychology, complicate selection of reliable corrective and preventive methods of preparing children with autism to master writing.

Neuropsychological theories of explanation of autism reflect the links between brain function and behaviour, success in activities (including written) due to unique manifestations of mental life, which is confirmed in many foreign and domestic works (Bachevalier, 1994; Baron-Cohen et al., 1985; Dawson, 1996; Happe & Frith, 1996; Hughes et al., 1994; Joseph, 1999; Luria, 1966; Minshew et al., 1997; Turner, 1997). Thus, the work of Joseph (1999) explains characteristics of behaviour of people with autism by the following theories: the theory of regulatory dysfunction, in which autism is seen as inability to program and control behaviour; the weak central coherence theory, which states that cognitive processing of information is incomplete, and covers limited areas; limbic theory, according to which disorders of psychological abilities, especially social, in particular communicative interaction, are associated with the medial part of the temporal lobes and the limbic system. Happe & Frit (1996), in turn, argue that cognitive theories are vital in neuropsychology, which seeks to establish a link between brain abnormalities and behavioral symptoms. The researchers explain autism at the biological, behavioral, and cognitive levels.

Autism is based on affective complexes, thinking disorders, isolation or activity of "strange" children, a deep violation of contact with other people; obsessive desire for monotonous forms of activity; high or low cognitive potential is possible. As a result, the psychological picture of autistic disorders can take many forms, from a child with a low level of intelligence, who does not speak and is maladapted, to a selectively gifted person with specific interests and "adult" speech. Children with such different levels of abilities need differentiated learning, so it is considered unacceptable to combine in one classroom children with autism with a significant degree of mental retardation with children with autism, which is characterized by high intellectual development (Ostrovska, 2012). Symptoms

of autism vary widely and may include: inability to communicate clearly, resistance to regime change, difficulty with social interaction, lack of eye contact, social detachment, difficulty in understanding one's own needs, repetition of words or phrases (Timmons et al., 2006).

We believe that children with intellectual disabilities need special attention to the correctional and preventive preparation of an autistic child for writing. According to Shevtsova & Poleshchuk (2016) children with intellectual disabilities have no formed at a sufficient level harmonious relationships between sensory and motor components of motor action, i.e., between such necessary components to ensure optimal psychomotor and perceptual-cognitive functions, which are undoubtedly involved in all forms of mental activity of children. At the same time, stereognosis and visual gnosis, which are based on the processes formed in early ontogenesis (tactile and visual perception, perceptual actions), as well as on the presence of images of surrounding objects in the child's memory, probably have a certain system-forming value. Peculiarities of the relationship between psychomotor skills and perceptual-cognitive functions in young students with intellectual disabilities must be taken into account when conducting educational and correctional work. In particular, if possible, it is necessary to work in parallel on those functions that include common links, ensuring strengthening of ties between them. Students with heterogeneous structure of psychomotor and perceptual-cognitive disorders need additional systematic practice of the most disturbed links based on better preservation. Thus, the results of neuropsychological examination of primary school children with intellectual disabilities enable to determine the directions of pathogenetically-oriented adaptive correction of disorders of psychomotor and perceptual-cognitive development, aimed at strengthening the psychophysiological basis of educational activities (Shevtsova & Poleshchuk, 2016).

The methodological basis for development of correctional and preventive programs for teaching autistic children to write in the context of our study is a neuropsychological approach to correctional and developmental work with special children (Baron-Cohen et al., 1985; Happe & Frith, 1996; Joseph, 1999; Luria, 1966, 2003; Minshew et al., 1997; Semago & Semago, 2000; Semenovich & Vorobeva, 1998; Shevtsov & Ilina 2015; Shevtsova & Poleshchuk 2016; Sirotyuk, 2003; Skrypnyk, 2010; Tarasun, 2017).

The neuropsychological approach, which is based on modern ideas according to the works of Luria (1966, 2003) on the laws of development and hierarchical construction of the brain organization of higher mental functions in ontogenesis, made it possible to create highly effective correctional technologies based on a systematic approach to correction of mental development of the child. One such system is a comprehensive method of psychomotor correction, created by a group of psychologists led by Semenovich (1998). Within this system, there are two different areas of correctional work: methods of motor correction, development of nonverbal components of communication, and cognitive methods aimed at overcoming difficulties in acquiring school knowledge and formation of higher mental functions used in a single complex with their subsequent integration taking into account the complementary impact. Actualization and consolidation of any bodily skills involves an external demand for mental functions such as memory, emotions, perception, self-regulation processes, etc., i.e., creates a basic prerequisite for full participation of these processes in mastering writing, reading, mathematical knowledge. Actualization of cognitive correction methods with their subsequent inclusion in the correction process should take into account the dynamics of individual or group work (Semago & Semago, 2000).

Cerebral representation of any mental or psychosomatic factor is invariant. It is subject to change, the brain organization of the function (speech, memory, perception, etc.), interfunctional processes (writing, arithmetic, reading) and complex patterns of behaviour (voluntary self-regulation, learning) is flexible. All this is a systematically-dynamic set of factors that are different in the degree of complexity. Neuropsychological factors (the group of basal factors include: modal-specific; kinaesthetic; kinetic; spatial; voluntary regulation of mental activity; energy supply; hemispheric interaction, etc.) are supporting components for further improvement of cognitive and emotional processes. The difficult multilevel construction of the child's individual personality is built and kept on them. It is impossible to change the "localization" of a factor, but one can naturally, or artificially create a system of actualization of the inter-factor connections, or superfunctional patterns. This is the main purpose of the neuropsychological correction. This process is possible due to plasticity of the child's neurobiological systems (Shevtsov & Ilina, 2015).

Researchers have shown that teaching children to write is closely related to their prior learning to read and the level of development of speech

and articulatory apparatus. In this regard, Tarasun (2012, 2017) argues that correctional and developmental work with children who have signs of impaired articulatory praxis and deficiencies in preverbal development should begin at the age of 1.5 months. Specially developed directions and methods of correction help to improve quality of articulatory movements, which allows in the initial stages of praxis formation to avoid formation of a stable pathological stereotype of movements. Lack of work aimed at prevention and correction of defects in preverbal development, disorders of articulatory praxis and successive stages of preverbal development, can lead to a child's general speech underdevelopment (Tarasun, 2012).

In our opinion, the sensorimotor development of autistic children is no less important for mastering writing skills, which causes intensification of development of all higher mental functions, which are essential for organization of a successful educational process. Thus, Skrypnyk (2010) in his neuropsychological approach to treatment of autism calls the method of "substitutive ontogenesis" an adapted version of basic body-oriented psychotechnics (optimization of general body tone, expansion of sensorimotor repertoire, formation of attention skills, etc.). Its application involves working out in the unity of the affect, perception and action. The neuropsychological correction is a three-level system. Each of the correction levels has its own specific "target" action and is aimed at all the three brain blocks. At the first level there is formation of the child's self-regulation with the help of body-oriented, art-therapeutic techniques, harmonization of synkinesis, expansion of the fields of visual perception, formation of sensorimotor interactions. The second level provides preconditions for the full formation of holistic mental functions (speech, memory, somatognosis, spatial representations, etc.). At the third level, the synthetic, integrative inter- and supra-functional interactions are corrected and formed, methods and algorithms of using generalized and regulatory language function, intellectual operations, voluntary attention, automated skills of voluntary self-regulation in emotional and cognitive aspects acquired at previous levels are consolidated. All methods (neuropsychological, logopedic, psychotherapeutic, etc.) are assimilated and modified into a new system (Skrypnyk, 2010).

The reason for difficulties in writing may be attributed to shortcomings in the complex coordination of sensorimotor processes: transformation of the time sequence of phonemes into a spatial series of graphemes, phonemic analysis and graphomotor operations of writing

letters. Difficulties in performing these operations are mainly due to the fact that both phonemic analysis and letter writing of words in chronological order are successive processes. Therefore, as a prerequisite for intelligence, they can suffer even with mild residual organic lesions of the central nervous system. In the chain of operations that make up the writing process, the final effector link are the graphomotor skills, which influence the writing process as a whole. Difficulties in writing letters sometimes so burdens the child's attention that disrupts all previous operations. It is important to emphasize that in ontogenesis graphomotor operations undergo a significant evolution simultaneously with the development of imaging activity. The most important function on which this process depends is formation of visual-motor coordination. Undeveloped or insufficiently developed graphomotor skills can cause a special kind of writing disorders. For all the clarity and perfection of the corrective-compensatory effect, which uses thoroughly developed methods and techniques for correcting defects in the skills of graphic symbolization of speech (in accordance with the phonetic principle of writing and grammatical rules of agreement of words in a sentence), in a significant number of children this dysgraphia grow persistent and, in some cases, cannot be corrected (Tarasun, 2017).

Neuropsychological recommendations for correctional and preventive preparation of autistic children to master writing

The principle of correctional and preventive orientation indicates the need for continuous adaptation of learning to the individual characteristics of the process of acquiring of the program material by students so that the cognitive skills formed in them are carried out quickly, joined-up, simultaneously, i.e., turned into a skill (Tarasun, 2017). Neuropsychological methods can be considered effective if they are used taking into account development of brain mechanisms of higher mental functions and their disorders and taking into account neuropsychological ideas about the causes, mechanisms and symptoms of mental dysontogenesis and the relationship of cortical and subcortical mechanisms of the brain when ensuring mastering handwriting by a child.

In this regard, for a comprehensive study of higher mental functions, it is appropriate to use a neuropsychological examination based on the Luria battery (1966, 2003) to identify neuropsychological functions of possible deficits of I (energy), II (cognitive), III (programming) brain blocks and diagnostics of the level of speech development and formation of

communicative skills in communication. The purpose of such diagnostics is to use a system of methods of correctional and preventive training, especially the method of "substitutive ontogenesis", adequate to the structure of the mental defect. The results of neuropsychological research, obtained in the process of didactic and role-playing games and on the basis of purposeful observation of children's behavior and manifestations of their mental life in everyday situations, are of great value.

The neuropsychological exercises for correctional and preventive training of autistic children, taking into account scientific ideas about functional blocks of the brain may include the following: exercises to develop proper breathing, formation and correction of sensorimotor interactions; distinction of noises (household, natural, musical instruments), voices of people, depending on remoteness of a sound source; teaching children a correct pronunciation of complex words, rapid speech, which enriches their vocabulary with new words (the same exercises may be given to parents to perform them at home); formation of logical-grammatical, "quasi-spatial" understanding begins with transition of the concepts "higher", "lower" to "above", "under", "in", "behind", "in front of"; oculomotor exercises (Shevtsov & Ilina, 2015).

In our opinion, such exercises should be combined comprehensively with an individual program for correctional and preventive preparation of an autistic child for writing. Application of any neuropsychological exercise should be based on the real resources of the child. For example, some children with autism respond better to images or sign language than to verbal presentation; children with autism may have difficulty understanding complex instructions, so they need to be "adapted"; it is appropriate to perform written exercises at the same time every day, so that the activity becomes predictable and turns into an interesting and fun task; psychologically do not put pressure on the child who does not like to write, but combine writing lessons with material of interest to the child in order to stimulate interest.

For special children with learning difficulties and weak social activity are characterized by the following neuropsychological indicators of the higher mental functions: lack of mental self-regulation, control of educational activities, information processing (at the level of visual, auditory, kinaesthetic sensations), rapid fatigability, inhibition of motor activity, low productivity, which is certainly associated with a deficiency of the cortical regions of the brain. Deficiency of neuropsychological components of

educational activity in older pre-schoolers and young schoolchildren requires development of individual programs with competently selected corrective and preventive means of preparing autistic children for writing. The correctional and preventive program for teaching autistic children to write should also include various types of productive activities: drawing, modeling, designing – in order to develop in them the musculoskeletal work of the wrists, visual-motor coordination, muscular-tactile analysers, kinaesthetic sensations.

We consider the use of the PEP-R test to be effective for successful teaching of autistic children. PEP-R can also be used for individual education programs for children with autism, but when selecting tasks for this program it is necessary to take into account the current level of development of the child. PEP-R provides information on the development of imitation skills, perception, fine and gross motor skills, visual-motor coordination, cognitive activity, communication and active speech. PEP-R also provides an opportunity to determine the degree of behavioural disorders in human relationships, the way to respond to external stimuli, as well as the degree of speech development disorders. PEP-R profiles have proved invaluable in the extremely important process of collaboration between parents and therapists. Parents effectively developed and conducted programs of education and upbringing at home (Ostrovska, 2012).

Vizel (2005) offers a set of exercises and tasks aimed at developing reading and writing skills in special children, forming in them logical thinking, spatial imagination, overcoming spelling and grammatical errors. The author testifies that children with autism have an innate reluctance to communicate with others, using speech as well. They are silent because they do not need to speak, although the speech areas of the brain and the speech apparatus in them are initially preserved (Vizel, 2005).

The method of Tarasun (2017) of gradual formation in children with developmental problems of the global way of writing is interesting. Thus, the basis of preparing a child for writing are drawing lessons, in the process of which it is important to form in children an attitude to drawing as a means for expressing freely their thoughts, developing the ability to see, optically distinguishing and measuring a subject. Exercises for transforming drawings can be a valuable technique for preparing a child for writing, as they contribute to formation of children's knowledge about mobility and variability of the subject and drawing with both hands at the same time. Drawing is supplemented by systematic exercises, for which purpose it is

necessary to eliminate, first of all, all kinds of obstacles to free hand exercises (lines in a notebook or on a sheet of paper, strictly defined letter sizes, etc.) and work out the correct position of the child's body at the table as an essential condition for the activity of the muscular system. The task of the teacher is not to achieve a calligraphic beauty of the child's writing, but to create favourable conditions for formation of individual, fast (running) handwriting (Tarasun, 2017).

An inclusive environment can provide opportunities for children with autism to increase their social interactions and, in turn, to improve their social skills. In order to increase academic performance, activities should be properly structured, learning - accessible, organized through cooperation with parents and competent teachers. Children with autism need to be praised and encouraged, although it is sometimes difficult (Timmons et al., 2006).

In neuropsychological recommendations to teachers of children with problems in psychophysical development Syrotyuk (2003) noted that if a child cannot read and write, then learning these skills simultaneously, neither will be optimally formed, because reading should precede formation of writing skills, the child must first understand the text and then read it; senseless training of memory, attention and self-control without normalization of brain work exacerbates the child's problems; fatigue complicates comprehension, systematization and memorization of information, because the brain work becomes so disorganized that the already established but not fixed nerve connections get ruined (Sirotyuk, 2003).

The correctional and preventive methods of work with autistic children considered in the context of neuropsychology are indicative, because for correction of mental development of a special child in each separate case the uniqueness and ambiguity of autistic manifestations successfully selected by a competent specialist neuropsychological techniques should be the best option. In this regard, in the correctional and preventive individual program for preparing autistic children for writing, the primary task is to "build" unformed mental functions in the unity of neuropsychological diagnosis, correction and programmed learning.

Neuropsychological methods in the correctional and preventive work of teachers and psychologists of special children should ensure, first of all, restoration or restructuring of impaired higher mental functions, to encourage the brain to create new interfunctional systems. At the

neuropsychological level, connections are made between brain structures, neuronal mechanisms, and mental and behavioural manifestations, including functions of writing that they mediate. With the help of restorative learning with the use of neuropsychological methods, superfunctional patterns are created, lost functions are formed, new interfunctional connections are actualized, which contributes to the optimal mastery of writing by autistic children. Functional systems of writing support, the neuropsychological and psychophysiological basis of which are higher mental functions, are formed in the process of activity. The main task of a neuropsychologist is to implement a competent integrated system approach to organization of the educational activities of autistic children with preliminary diagnosis of mental development disorders of autistic children and selection of adequate correctional and preventive methods for successful mastering of writing by them.

Conclusion

To successfully master writing, autistic children need personality-oriented learning, based on an individual approach to each child with special educational needs, inclusive partnership, high competence of specialists, involvement of autistic children in secondary schools and creating a comfortable developmental (sensory saturated) educational environment for such children through emotional contact and inclusion in psychomotor action. The primary task of the inclusion process is to provide special children with psychological and pedagogical support, preparing them for a successful transition to adulthood with confident mastery of social skills necessary for socialization – reading, writing, speaking, optimal social interaction with the environment.

The neuropsychological bases of correctional and preventive preparation of children with autism for writing are: study of symptoms of basic disorders of the brain blocks and structural functional organization of the brain, taking into account scientific views on its functional blocks – regulation of brain activity (the energy block); the block for receiving, processing and storing information; the block for programming, regulation and control of educational activity and optimal selection of correctional and preventive methods of teaching writing according to neuropsychological examination of a child with autism.

Corrective and preventive methods of teaching children with autism in writing should be selected at the research-creative and analytical-

evaluation levels, taking into account personal needs and the current state of psychophysical development of the child and prevention of secondary disorders. Educational and correctional activities of defectologists, oligophrenic educators, social educators, speech therapists and neuropsychologists should be integrated, professionally diverse, humane. Personal empathy, positive-tolerant attitude to students and positive emotional tone of the teacher can increase effectiveness of professionally selected correctional and preventive teaching methods for special children.

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