

Analysis of Conditions for Effective Use of Information and Computer Technologies When Organizing the Educational Environment of Students of Primary School Age with Neurodynamic Deficiency

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ABSTRACT

The article is devoted to the theoretical analysis of rational conditions and risk factors when using information and computer technologies in the process of building an educational space for primary school students with neurodynamic deficiency. A comprehensive approach to this problem is presented, including the analysis of neuropsychological and psychological-pedagogical aspects of the organization of the educational environment. On the basis of classical methodological concepts and modern neuropsychological research, separate variants of neurodynamic deficiency are considered, and ICTs capabilities specific to each type are differentiated, as well as resource limitations of their use due to the specifics of neuropsychological symptoms. The article analyzes the factors of psychological security and threats to reduce it when solving educational tasks using ICTs. Recommendations on the use of ICTs in the construction of a educational space for students of this category are formulated. The material is recommended for improving the professional competence of teachers who use ICTs in an inclusive educational model.

Keywords: *students with neurodynamic deficiency, information and computer technologies, psychological security of inclusive educational space*

1. INTRODUCTION

Information and computer technologies (ICTs) are currently being intensively introduced into the modern school system and are becoming an effective tool for building an educational space. For students, ICTs are an attractive means of obtaining information, for teachers - a method of solving problems related to both the formation and assessment of the level of formation of educational competencies [10]. Specialized programs for development and correction are created on the basis of computer technologies, focused on specific categories of students. Yu. F. Garkushi, L. R. Lizunova and Z. A. Repina proposed programs for teaching children with speech disorders. Under the guidance of O. I. Kukushkina, a whole package of computerized materials was created for students with mental retardation, hearing and speech disorders.

Thus, the role of ICTs is not limited to solving educational tasks, it is expanded by updating correctional and developmental resources, mechanisms for compensating for various deviations in the development of the psyche. However, in the theory and practice of psychological and pedagogical support, the question of the usefulness of

these methods and the risks that arise from their irrational use remains controversial. There is often conflicting information about the negative and positive impact of computer technology on the developing brain and psyche in general [6,7].

When entering an educational organization, modern children usually already have a solid audio-visual experience of interacting with a computer and fairly stable media preferences, but media culture often turns out to be unformed. The authors differentiate typical problems for students of primary education due to low media culture:

- informational overload (information stress), which leads to fatigue and emotional disorders;
 - narcotic effect that causes excessive attractiveness of the computer world as emotionally rich, able to compensate for the emotional and social deprivation of modern children growing up in a rationalized world;
 - disproportionate stimulation of an immature nervous system. The predominance of the load on the visual analyzer, the lack of the ability to consolidate stimuli of different modality, leads to incorrect functional maturation of the brain, disharmony of its work [6, 7].
- In this regard, primary school age students who, without formal diagnoses, demonstrate limitations of mental

resources and stand out for cognitive disharmony due to neurodynamic deficiency, fall into the zone of special attention (L. A. Yasyukova, A. R. Agris) [1,3,4,9]. This deviation from the point of view of neuropsychological symptoms is considered as a violation of the functions of the first block of the brain (A. R. Luriya), which is reflected in a decrease in the energy and activation components of educational activities (N. M. Pylaeva, T. V. Akhutina) [5]. At the same time, other indicators of mental activity productivity also suffer: the speed of processing sensory information, its consolidation, decreases, etc. (A. R. Agris) [1,3]. Such features, although they are the basis of certain school difficulties, are not an obstacle to obtaining a required education in an inclusive educational model. At the same time, it is necessary to create adapted conditions that include rules for the use of ICTs.

Despite the fact that the number of children with neurodynamic deficiency, as well as with other neuropsychological syndromes, is steadily growing, the specifics of using ICTs in building an effective educational space for this category of students are still a little studied issue. The problem of psychological safety of ICTs use with children with neurodynamic deficiency is relevant [8].

The above mentioned defines the purpose of the study - the analysis of the conditions for the use of ICTs in relation to students with neurodynamic deficiency, providing them with psychological security in an inclusive educational space.

2. METHODS OF RESEARCH

The methodological basis of this research is:

- the stances is of L. S. Vygotsky on the need for a clear separation of the concepts of primary, anatomical and physiological nature of the defect, and secondary deviations of mental development;
- the stances of L. S. Vygotsky on the social conditions for the formation of higher mental functions;
- A. R. Luriya's concept of the three blocks of the brain, the systemic nature of its work;
- modern ideas about neurodynamic deficiency in primary school age students (T. V. Akhutina, N. M. Pylaeva) and the likelihood of their overcoming (or worsening) in learning activities (L. A. Yasukawa).

Research methods: content analysis, theoretical modeling.

3. THE RESULTS OF THE STUDY

Currently, there is a high incidence of symptoms of deficit of neurodynamic components of activity with students at the primary education level. These symptoms are accompanied by various difficulties in mastering the general education program and specific disorders of educational skills.

In foreign literature, the problem of deficit of neurodynamic components of activity is considered mainly in the framework of research on the influence of cognitive (processing) load and information processing speed on the effectiveness of cognitive activity, as well as the problem of automation of cognitive and motor skills [11]. Based on this conceptual approach, the problems of switching (transition) from the sign system of information presented in textbooks and notebooks, on the screen of multimedia to the system of practical actions become relevant. Such switching requires maximum independence from students and goes beyond the available resources. The authors point out that ignoring these features when using ICTs significantly increases the risk of forming conventional thinking, a lack of initiative attitude to learning activities, and manifestations of increased fatigue.

In Russian studies, neurodynamic deficiency is considered as a violation of functioning of the first block of the brain [2]. At the physiological level, this is manifested in functional insufficiency of the brain stem, diencephalic (hypothalamic-pituitary) region, limbic system and other subcortical structures [1,3,4]. The variety of localization of violations determines the variability of deviations of mental indicators, which, in turn, provides a basis for differentiation of specific conditions of the organization of the educational space.

Thus, the deficit of brain stem formations at the neuropsychological level is manifested as modally non-specific violations of attention and short-term memory: the students are characterized by rapid depletion and transition of active attention to passive under intellectual loads, difficulties in strengthening memory traces. As the authors point out, these symptoms are manifested in any form of activity in solving educational tasks - sensory, gnostic, intellectual. However, after a period of severe exhaustion, a repeated "surge" of activity is possible, which makes it possible to partially compensate for negative manifestations through additional motivation with the help of ICTs. Thus, the use of these methods in relation to students of this subgroup can have an activating effect.

Similar modally non-specific violations of the prerequisites of intellectual activity are also manifested in the damage of the diencephalic (hypothalamic-pituitary) region and limbic structures [1,3,4]. However, the effectiveness of ICTs as motivating technologies in relation to students with such symptoms is questionable, since their emotional sphere is unstable. There is a risk of inadequate affective reactions. In addition, as the authors point out, any overload or introduction of side activities between memorizing and reproducing the material leads to inhibition of memory traces. In neurodynamic insufficiency, various variants of impaired activity regulation functions are also identified, most of which, as A. R. Agris points out, fit conditionally into two subtypes: the first subtype is high, but insufficiently regulated by mental tone, which is essentially an attention deficit hyperactivity syndrome; the second is a reduced mental tone, which fits the definition of asthenic and inhibited

type of minimal brain dysfunction (L. A. Yasyukova). Agris points out that depending on the type of violation, there are features of processing sensory stimuli of different modality. In particular, the author found that the processes of processing kinesthetic and auditory-speech information are somewhat worse developed in children with a low cognitive rate, whereas in hyperactivity, these indicators differ much less from those of normo-typical children. In addition, there are differences in dynamic indicators. By the time of completion of the primary level of education, students have a gradual mitigation of symptoms of hyperactivity, while the severity of symptoms of slowness and fatigue does not significantly change.

Table 1 The analysis of psychological manifestations of neurodynamic deficiency in the use of information and computer technologies in education (by L. A. Yasyukova)

Manifestations of neurodynamic deficiency	The potential of ICTs to facilitate learning tasks	Risk zones in the inefficient use of ICTs
Rapid mental fatigue, which may not be combined with general somatic asthenia.	Relief of cognitive stress through reliance on a more productive sensory channel (visual perception) and motivational stimulation	Overly-bright sensory stimuli that include both auditory and visual information can be a factor in cognitive overload
Sharply reduced possibility of self-government and voluntary regulation	Including additional emotional charge of the material, relying on involuntary attention	High attractiveness of ICTs reduces the need to train voluntary attention and self-regulation in general
Severe violations of activity during emotional activation (both positive and negative)	The ability to predict and model the emotional load in the formation of ICT	High attractiveness of ICTs activates emotional responses, which increases the risk of disorganization of educational activities
Changes in time and relaxation cycles in brain activity	The ability to predict and model the information load in the formation of ICT taking into account relaxation cycles	There is no possibility of flexible changes in the information flow when the features of relaxation cycles are actually manifested in the educational process

4. DISCUSSION OF RESULTS

The analysis of various theoretical concepts and empirical data enables to formulate pedagogical conditions for the use of ICTs in the organization of an educational environment for students with neurodynamic deficiency. Consideration of these conditions is an important component of professional competence of a teacher implementing an inclusive educational model [10].

1. With increased mental tone and violation of self-regulation in students, the order of presentation of information technologies and their total number is important. The sequence should involve alternating activities, changing the child's psychophysical state: from mobile to calm, from cognitive technology to relaxation. The number of information technologies should not exceed 2-3.
2. Given the high risk of disharmonic sensory stimulation, it is necessary to include kinesthetic and general motor activity in ICTs.
3. Due to general mental immaturity, multifunctional information technologies should be excluded. That is, one

Thus, students belonging to different subtypes will show differences in the assimilation of information of different modality, which is important to take into account when forming the content of ICT.

Neurodynamic deficiency in the concept of L. A. Yasyukova is considered as a manifestation of minimal brain dysfunction [9]. The author emphasizes that the preservation of the intellectual sphere in students of this category is combined with cognitive disharmony, which can cause school failure. The analysis of neurodynamic disorders described by L. A. Yasyukova enables to determine the features of the use of ICTs in relation to this category of students.

technology should be focused on one channel of perception and train one mental process: attention or perseverance.

4. Due to emotional instability, it is necessary to limit the variety of information technologies used, since overloading with novelty can reduce the effectiveness of their application. This condition can be achieved by varying the use of a single technology (using separate elements, building educational material on the principle of rising complexity, etc.).
5. Special attention should be paid to health-saving technologies and rules of psycho-hygiene, which may be of key importance for students with neurodynamic deficiency. This condition can be implemented as follows: conducting dynamic pauses (relaxation) with the use of ICT tools, using an interactive whiteboard for conducting oculomotor exercises to prevent visual fatigue, conducting exercises for the development of visual-motor coordination, which can also contribute to the development of self-control, etc.

5. CONCLUSION

Information and computer technologies are becoming an integral part of the educational environment, which implies special attention to the conditions for their effective use in relation to students with resource constraints. In the process of theoretical analysis we differentiated potential threats to psychological safety while using ICTs in relation to children with neurodynamic deficiency:

1. High risk of negative emotional and behavioral symptoms associated with fatigue and sensory-emotional overload.

2. Difficulty in acquisition of the material presented simultaneously in several sensory systems.

3. Increased cognitive disharmony due to disproportionate stimulation of visual associative zones.

Minimizing these threats is possible by building a comprehensive model for the use of ICTs, taking into account the variety of manifestations of neurodynamic deficiency in students. In this regard, increasing the level of competence of teachers when using ICTs in an inclusive educational space is an important task related to the problem of ensuring psychological security.

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