Neurophysiological Aspects of Implementing a Comprehensive Interdisciplinary Approach in Supporting the Education of Schoolchildren with Health Disabilities

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Abstract: The article analyzes theoretical aspects of the problem and the data of our neurophysiological study previously conducted on the state of the central nervous system (CNS) of students with impaired intelligence. The authors reasonably show the need to study the characteristics of mental development and the organization of training and education of persons with intellectual disabilities in the framework of a comprehensive interdisciplinary approach, with an emphasis on the neurophysiological aspect. The authors highlight the features of the bioelectric activity of the brain, in particular, certain parameters of the main rhythm of the central nervous system (in particular, the α-rhythm). They can be considered as highly informative indicators not only of the specifics of the brain activity of children with health disabilities but also as the basis of the specifics of the mental development of children with disabilities. Besides, these indicators serve as a neurophysiological substrate for the organization of effective corrective development work during the training and education of the studied contingent of schoolchildren. As a result, the authors determine not only the need for an interdisciplinary approach in studying the characteristics of people with disabilities, but they also substantiate the insufficient development in the defectological theory and practice. In addition, the authors prove the need for its theoretical justification by specialists of the biomedical profile and its consideration by teachers in practical activities. Its consideration and development achieve the implementation of this approach at the theoretical, methodological, and practical levels.

1. Introduction

Modern society enters the stage of complex interdisciplinary study and development. All spheres of the life of a modern person are considered from the perspective of generalized knowledge. This applies to purely scientific theoretical research, as well as applied research [1]. One of the results of such a comprehensive development of society was the humanization of its consciousness, expressed in close attention to the problems of people with HIA and disabilities. The psychological and pedagogical approach developed in previous decades in Russian defectology, accompanied by persons with disabilities in the process of their education, is clearly insufficient today [2]. The requirements of society and the state of mental development of the younger generation, including people with disabilities, enshrined in a number of basic federal documents imply a deeper psychological and pedagogical study of the mechanisms of mental development impairment. Nowadays, this approach, relevant in the past and certainly made a significant contribution to the study of individuals with disabilities, should be deepened by the neurophysiological aspect. The development of neurobiological science, advances in the study of the functioning of the normal and impaired brain, bring out the neurophysiological aspect in explaining the mechanisms of impaired mental development of persons with disabilities to leading positions [3].

It should be noted that the justification and implementation of a comprehensive neurophysiological and psycho-pedagogical approach in the study of children with disabilities should be the basis for changing the existing system of support for the education of people with disabilities [4]. This change should concern all its levels, starting with the training of new generation of defectologists, whose professional competence is based on neurophysiological knowledge, and ending with the development of new technologies for the education and upbringing of children with disabilities. Therefore, science and practice are faced with the question of a more detailed development of the neurophysiological aspect of accompanying people with disabilities, searching for highly informative neurophysiological indicators of impaired development and their interpretation in terms of providing effective psychological and pedagogical assistance. This is very relevant for people with intellectual disabilities [5], whose defect structure is based on a total organic lesion of the central nervous system, more pronounced in the higher part of the brain – the cerebral cortex, which leaves a special imprint on the functional organization of the central nervous system in the process of mental activity and in the process of mental development of a child with mental disability.

Thus, it is necessary to study and interpret highly informative indicators of the brain activity of people with intellectual disabilities as an indicator of the specifics of their mental development and the basis for organizing their effective accompaniment during training and education [4; 5].

The main objective of this study is based on the analysis of data from a previous neurophysiological examination of elementary school students with intellectual impairment (MBOU “S (K) OSH No. 119, Chelyabinsk), the selection and justification of highly informative neuro-indicators of the functioning of the central nervous system. It is necessary to justify these indicators as one of the foundations of professional knowledge of modern defectologists for organizing effective support for the education of children with disabilities.

The subject of this study is the substantiation of certain parameters of the functioning of the central nervous system of primary schoolchildren with impaired intelligence as indicative indicators of a decrease in the level of their intellectual development, as well as an information base for understanding the mechanisms of impaired mental development by specialists working with these students. It is about advancing the understanding of the neurophysiological features of the brain that has an organic damage in the process of age-related development or the implementation of mental, intellectual activity. It allows psychological and pedagogical specialists to increase their professional competence significantly and to accompany the education and development of such children in a more qualitative way, at a level that meets the requirements of the modern stage of development of defectological science and correctional and pedagogical practice [6]. The availability of high-quality biological knowledge and an understanding of the mechanism of impaired development at the neurophysiological level will help educators-defectologists to organize correctional work on a fundamentally different basis. In particular, it could be done on the basis of a comprehensive perception of children, seeing them as a biosocial creature that responds effectively to complex influences and is biological and socio-psychological in nature. This is exactly what meets the requirements of today’s comprehensive multidisciplinary approach in the study of people with disabilities.

Thus, the main problem of this study is the evidence-based justification for the need to develop at a theoretical and methodological level the necessity to search for neurophysiological indicators of impaired development, their interpretation in this aspect, as well as the substantiation of knowledge of these neurophysiological indicators as an important component of the general professional competence of specialists working with children with impaired intelligence [6].

2. Materials and Methods

In the course of substantiating the theoretical foundations of the neurophysiological aspect of an integrated approach to the organization of training and education of schoolchildren with intellectual impairment, a methodological basis was determined, which became an interdisciplinary approach.

The implementation of an interdisciplinary approach [1; 2] in the framework of this study involves, on the one hand, taking into account the neurophysiological indicators of impaired development (the brain bioelectrical activity of the child's nervous system as a whole, its individual parameters:), and, on the other hand, the implementation of this knowledge by the teacher in the process of professional support for each student.

It is an interdisciplinary approach that allows us to build a system for supporting the education of schoolchildren with intellectual impairment according to the principle of an individual approach to teaching a child – the basic didactic principle of both classical and modern defectology. More than that, such an approach contributes to the maximum minimization of manifestations of impaired development and their most effective socialization at all subsequent age stages [4].

Achieving the main goal of the study was due to the use of a combination of adequate and highly informative research methods. In particular, we relied on the method of analysis of the obtained data: a retrospective analysis of scientific and periodic literature, the results of our own neurophysiological research; content analysis of materials of scientific events at various levels from international to regional (scientific and practical conferences, symposia, and meetings on the research problem); methods of primary mathematical processing; free description method; diagnostic data collection methods.

The analysis of the data of a neurophysiological study of elementary schoolchildren with impaired intelligence allows us to identify the main neurophysiological indicators of the functioning of the central nervous system of students with a deviation in mental development, which creates the basis for solving this problem at the theoretical, methodological, and practical levels [6].

3. Results

Summarizing the results of our theoretical analysis and empirical study on the current state of the problem of supporting the education of people with intellectual disabilities, based on comprehensive interdisciplinary research of the features of their development, we can draw the following conclusions.

The theoretical and methodological level of studying the neurophysiological aspect of studying individuals with intellectual disabilities is traditionally one of the promising and priority areas of theoretical research and practical development in the field of modern defectology:

1. The main trend in the age-related design of brain bioelectrical activity (BEA) is the gradual formation of the α-rhythm as the leading rhythm of brain functioning [5; 7; 8; 9]. Therefore, the α-rhythm was subjected to comparative analysis in an electroencephalographic (EEG) examination of children with mental deficiency.
2. A detailed analysis of the data of a practical previously conducted neurophysiological study shows that the EEG of elementary school students with impaired intelligence is characterized by large individual variability, high-amplitude activity, and fuzzy spatial organization [5; 10]. This regularity can be considered as the theoretical basis and manifestation of the individual structure of the defect in mental deficiency.
3. It should be emphasized that a neurophysiological study made it possible to single out brain BEA, characteristic only for EEG of children with intellectual impairment at a statistically significant level. These are the characteristics of the alpha rhythm of the EEG wave, such as amplitude and regularity [5]. These indicators should be considered as indicative of highly informative neurophysiological indicators of a decrease in the level of intellectual development to the level of mental deficiency [11].

The indicated list of experimentally obtained data may not be a complete register of neurophysiological indicators, at a statistically significant level distinguishing the results of a neurophysiological examination of primary school children with normal mental development and with mental deficiency. The analytical review includes only those results that were first obtained or confirmed in the course of our own neurophysiological examination. However, the total number of selected indicators and the availability of information interesting for our study in the works of other authors indicates that the neurophysiological aspect of the study of impaired intellectual development remains relevant, priority, and requires further development.

At a practical level, the study of the neurophysiological aspect of the study of persons with intellectual disabilities can state the following.

1. In the context of the transition of higher education to new educational standards in the preparation of specialists of a defectological profile, one should consider the possibility of increasing the number of disciplines of medical and biological profile in the curriculum. Their content may include a neurophysiological component. This is a requirement not only of the modern paradigm of higher

education but also the practical implementation of a comprehensive interdisciplinary approach in the preparation of defectologists with higher education [1; 2].

2. Strengthening the neurophysiological aspect of the training of defectologists at both levels of higher defectological education is considered not only as possible but also as logical. At the undergraduate level, it is possible through elective disciplines [6].
3. For practitioners defectologists who have received professional education earlier, during the priority period of the classical, exclusively psychological, pedagogical, approach to the organization of education, the neurophysiological aspect should be included in the program of compulsory continuing education courses.

4. Discussion

The ongoing modernization of the domestic system of educational services to people with disabilities, innovative processes in the theory and practice of correctional education make certain changes to the organization of study in theory [1; 2] and implementation in practice [4; 5] of training and education of various categories of students with disabilities, including people with intellectual disabilities. Concerning children with HIA, interdisciplinarity should be considered, first of all, a combination of the classical psychological and pedagogical aspects and giving it a modern integrated character of the neurophysiological aspect [3]. Regarding the categories of children with impaired development allocated today in the framework of this study, the most indicative category is "children with intellectual disabilities." The contemporary researchers consider the concept of "impaired intelligence" as a persistent decline in human cognitive activity in the context of organic damage to the central nervous system [4; 7]. In turn, it allows us to characterize the uniqueness of BEA as the main indicator that determines the decrease in the level and quality of intellectual development and, thus, determines this state [8; 9]. This position actualizes not only the search for highly informative neurophysiological indicators of the peculiarity of BEA of the nervous system in children with impaired intelligence [4; 5; 11] but also the rationale for the use of these data in the practical activities of educators-defectologists [6].

The neurophysiological aspect of accompanying the education of schoolchildren with intellectual impairment should become fundamental in the organization of their training and education. Understanding by the teacher-defectologist of the mechanism of impaired development at the neurophysiological level allows a deeper understanding and better implementation of correctional development work [6].

The problem of implementing an interdisciplinary approach in studying the characteristics of mental development and the organization of training and education of children with disabilities, identified in the framework of this study, requires further study at both the theoretical and practical levels.

5. Conclusion

Innovative processes in defectology and modernization of the country's special education introduce new trends in the organization of supporting people with disabilities in general and students with intellectual disabilities in particular. The educational process should meet modern trends in the development of defectological theory and practice. Nowadays, the leading approach in the study of people with disabilities is a comprehensive interdisciplinary approach, in which the neurophysiological aspect begins to play a major role, in addition to the traditional psychological and pedagogical aspect. It is the neurophysiological aspect that allows, at a fundamentally new level, based on a deeper understanding of the mechanisms of impaired development, to build a correctional and educational process.

As a result of the analytical study, we identified the need to develop a comprehensive multidisciplinary research of students with intellectual disabilities at two levels (theoretical/methodological and practical). This approach allows not only to substantiate its relevance in a reasoned manner but also to solve it in accordance with the requirements of modern defectological science and social reality.

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