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THE PECULIARITY OF NEURO-DIDACTIC CONTENT AIMED AT DEVELOPING THE INTELLIGENCE OF PRIMARY SCHOOL STUDENTS

Abstract

The article describes the specifics of neurodidactic content aimed at developing the intelligence of primary school students. The theoretical foundations of neurodidactic, including the concepts of neuroplasticity and cognitive development, are considered. The neuro-didactic content aimed at developing the intelligence of younger schoolchildren is analyzed. The meaning of the concept of neuro-didactic content is revealed, its definition is given, and its effectiveness and capabilities are revealed. A survey was conducted to determine the knowledge of primary school teachers about neurophysiological features, the development of the intelligence of primary school students, and neurodidactic content, to determine what work they do in the development of the intelligence of their students, and to clarify the content of neurodidactic content and determine the possibility of neurodidactic content in the development of students ' intelligence. The results were verified using a coefficient scale and displayed as a diagram and a table. According to the survey results, the educational level of primary school teachers in intelligence development with the help of neurodidactic content was determined, as well as the content of neurodidactic content for the development of intelligence of younger schoolchildren.

Keywords: neurodidactic, neuropsychology, intelligence, neuro-didactic content, primary school student.

Introduction. In the modern educational process, one of the key tasks is the development of intellectual abilities in younger schoolchildren, which requires the implementation of innovative approaches and teaching methods (Liljestrand, 2024; Herodotou et al., 2019). In this context, neurodidactics, a field based on the integration of neuropsychology and pedagogy, becomes particularly important. Neurodidactic content is aimed at activating cognitive processes in children, such as memory, attention, and thinking, which not only contributes to the successful assimilation of educational material but also fosters overall intellectual development.

The uniqueness of neurodidactic content lies in its ability to take into account the individual neuropsychological characteristics of each student, allowing educational programs to be maximally adapted to their needs and peculiarities. This is especially relevant in primary school, where children are just beginning to develop basic learning skills and key cognitive functions. It is important to note that such content is based on scientific research and experimental data, ensuring its effectiveness and success in educational practice.

Exploring the features and potential of neurodidactic content for younger schoolchildren opens up new prospects in the field of education, offering teachers and learning specialists innovative tools for fostering a lasting interest in learning and advancing children's intellectual abilities to a new level.

At the core of neurodidactics is the belief that cognitive skills can be purposefully developed through targeted educational techniques. By focusing on exercises that engage specific brain functions, neurodidactic methods help lay a foundation for lifelong learning capabilities. Such techniques enable young students to approach learning with increased concentration, resilience, and flexibility, which, according to recent research, are essential traits for successful academic and personal growth (Liljestrand, 2024).

Furthermore, neurodidactics emphasizes creating a stimulating classroom environment

that integrates hands-on activities and interactive experiences. These types of activities help bridge theoretical knowledge with practical skills, making learning both engaging and effective. As studies indicate, children who are actively involved in such neurodidactic exercises not only retain information better but also develop a deeper understanding of the material, which contributes to sustained intellectual development (Sousa, 2016).

The ultimate goal of the neurodidactic approach is to develop stable cognitive skills in young schoolchildren that will facilitate their successful adaptation to the learning process and foster lifelong intellectual abilities. In primary education, the integration of neurodidactic content not only helps children better assimilate educational material but also cultivates a motivation for learning, an interest in independent study, and readiness to tackle complex tasks. Thus, exploring the features and potential of the neurodidactic approach opens new prospects for education, offering teachers and specialists modern tools for effectively advancing the intellectual potential of young students.

Materials and methods. In recent years, the issue of developing the intellect of younger schoolchildren has gained particular relevance due to the changing demands on educational systems. Modern research highlights that traditional teaching methods, primarily focused on knowledge transfer, often fail to meet the new challenges related to the need for children to develop more complex cognitive and metacognitive abilities (Farkhutdinova, 2022; Lane et al., 2022).

Many researchers, such as Gardner (2008) and Renzulli (2020), point out the necessity of moving from a knowledge-based teaching model to one that fosters critical thinking, creativity, and problem-solving skills. These changes are driven by the needs of contemporary society, which requires individuals to be highly adaptable and capable of lifelong learning.

Studies by neuropsychologists, including the work of Kovach (2013), show that younger schoolchildren are at a critical stage of cognitive development, where it is crucial to support and stimulate functions like attention, memory, and logical, and spatial thinking. However, traditional curricula often do not account for individual differences in the development of these cognitive functions, which can lead to decreased learning motivation and academic performance.

The literature also emphasizes the challenges associated with the need to individualize the educational process. Lebedeva (2020) and Petrova (2022) note that modern students have diverse cognitive profiles that require differentiated approaches. However, schools often lack the tools and methods to effectively address these differences in the learning process.

A significant influence on the cognitive development of younger students is the digital environment in which they are growing up. Studies by Carr (2020) and Ivanova (2022) show that constant interaction with gadgets and multimedia resources alters how information is perceived and reduces the ability to concentrate. This places an additional burden on educators to not only develop cognitive skills but also teach children to interact effectively with information streams.

Moreover, recent studies emphasize the importance of neuroeducational literacy for teachers, as this knowledge can greatly enhance the effectiveness of education. Zhumabayeva et al. (2024) found that comprehensive neuroscience training significantly improved the neuroeducational literacy of prospective teachers in Kazakhstan, equipping them with valuable insights into students' psychophysical development. This neuroeducational literacy allows teachers to implement more effective strategies for cognitive and behavioral engagement in the classroom, fostering a more individualized learning environment and aligning with neurodidactic approaches (Zhumabayeva et al., 2024).

Against the backdrop of these challenges, the topic of neurodidactic content is becoming highly relevant. Neurodidactics offers a scientifically grounded approach that considers the brain's functioning and neuroplasticity during the learning process. This allows for the development of educational programs aimed at

the optimal development of cognitive functions, taking into account the individual characteristics of each student.

Studies also show that digital competencies are gaining increasing importance in the educational environment of younger schoolchildren, especially in aspects of safety and the ability to navigate the digital space. Li et al. (2024) developed a Digital Intelligence Quotient (DQ) scale for Chinese primary school students, which allows for identifying their level of development of key digital skills. The scale includes seven components covering aspects such as digital identity, safety, and emotional intelligence, emphasizing the necessity of these competencies in primary education (Li et al., 2024).

First, neurodidactic content is based on data about how different types of information are perceived and processed by the brain. This helps educators use methods and materials that most effectively stimulate the development of memory, attention, and other cognitive processes in younger students.

Second, neurodidactics promotes individualized learning, addressing the challenges posed by the diversity of students' cognitive profiles. This is especially important in primary school, where the foundations of a child's learning motivation and self-esteem are established.

Third, neurodidactic approaches help children adapt to the digital environment, developing critical information perception skills and the ability to concentrate in a world saturated with diverse information streams.

Thus, research confirms that neuro didactic content not only meets modern educational requirements but also has the potential to overcome existing problems in the education of younger schoolchildren, making its implementation in educational practice, especially important.

In recent years, there has been a noticeable increase in interest in integrating neuropsychology into educational practice. This trend is driven by a growing understanding that successful learning is impossible without considering the brain's functioning, cognitive processes, and neuroplasticity.

1. Growing Interest in Neuropsychology in Education:

Modern research emphasizes that traditional teaching methods often overlook individual differences in the development of cognitive functions such as attention, memory, and thinking. In this regard, neuropsychology offers valuable insights into how the brain perceives, processes, and stores information. This knowledge enables the creation of more tailored educational methods that promote effective learning for each child, regardless of their characteristics.

2. The Promise of the Neurodidactic Approach:

The neurodidactic approach, based on the principles of neuropsychology, is considered promising for several reasons:

-neurodidactics enables the development of educational programs that take brain mechanisms into account, thereby promoting deeper and more sustained knowledge retention. These programs include exercises and tasks that stimulate specific brain areas, strengthening neural connections and enhancing cognitive functions.

-one of the key advantages of the neurodidactic approach is its ability to adapt to the individual cognitive profiles of students. This is particularly important in primary school, where the foundation for future academic success is laid. Neurodidactics offers methods that cater to each child's learning pace and style, fostering more successful intellectual development.

-the neurodidactic approach is based on verified neuropsychological data, making it a reliable tool in educational practice. Unlike traditional methods, which are often based on intuitive approaches, neurodidactics offers objective, scientifically grounded solutions to improve students' cognitive abilities.

- in an information-driven world, where children are exposed to vast amounts of data and digital technologies, neurodidactics help develop critical thinking skills and the ability to concentrate. This makes it particularly relevant in the context of modern educational demands.

Thus, the integration of neuropsychology into educational practice through neuro didactic approaches not only enhances the effectiveness of learning but also addresses modern challenges related to the need for individualization and adaptation of educational programs to new conditions.

Neurodidactics is based on several key theories and concepts that explain how cognitive processes develop and function in the brain, and how they can be optimized through targeted learning. These theories and concepts allow the development of educational programs that effectively nurture the intellect of younger schoolchildren.

One of the foundational concepts of neurodidactics is neuroplasticity, the brain's ability to change and adapt in response to learning and new experiences. The research of Merzenich (2013) demonstrated that the brain remains plastic throughout life, and new neural connections can form in response to learning, which is a key aspect of an effective educational process.

Neurodidactic approaches apply the principle of neuroplasticity to design learning programs that stimulate the active involvement of various brain areas. For example, exercises aimed at solving logical problems or developing memory help strengthen neural connections and improve students' cognitive functions. This not only aids students in absorbing new knowledge but also develops skills such as attention and problem-solving abilities.

Cognitive development theories, such as Piaget's theory (1951) and Lev Vygotsky's (1978), cultural-historical theory also form the foundation of neurodidactics. Piaget (1951) proposed that children go through specific stages of cognitive development, each characterized by distinct ways of thinking and understanding the world. Vygotsky emphasized the importance of social context and interaction in the development of cognitive functions.

Neurodidactic approaches take these developmental stages into account and create learning materials that align with children's age-related cognitive characteristics. This enables children to effectively absorb information suited to their level of cognitive development, gradually progressing to more complex tasks. For example, classification and seriation exercises can be used to strengthen logical thinking at early stages of education.

Modern learning theories, such as Paivio's (2014) dual coding theory and Sweller's (2016), cognitive load theory explore how information is processed by the brain and how different forms of information representation can influence its retention. Paivio (2014) asserts that information is better remembered when presented in both verbal and visual forms, a concept actively applied in neuro didactic methods.

Neurodidactics also considers the cognitive load, aiming to minimize it to prevent overloading students' working memory. This is achieved by breaking down complex information into smaller, manageable parts, allowing students to gradually and efficiently assimilate new material. Studies, such as the work of Geiger and Brewster (2009), show that neuro didactic methods can significantly enhance cognitive functions like memory, attention, and thinking. For example, working memory training exercises used in neuro didactics help children better retain and process information, improving their performance across various academic subjects.

In addition, methods like mindfulness, which are also incorporated into neuro didactic programs, contribute to improving attention span and reducing stress levels in younger schoolchildren. This, in turn, positively affects their overall cognitive and emotional development. Many neurodidactic programs also utilize principles of multisensory learning, based on the idea that learning through multiple sensory channels (sight, hearing, touch) promotes better retention and understanding of material. Gardner's (2008) work on multiple intelligences supports the use of various sensory and cognitive approaches to meet the individual needs of students.

Thus, neuro didactics, drawing on fundamental theories of neuroplasticity, cognitive development, and neuropsychological learning principles, offer approaches that not only enhance cognitive functions but also adapt to

the individual characteristics of students. This makes it a vital tool in modern education, aimed at the intellectual development of younger schoolchildren.

In recent years, numerous empirical studies have been conducted to evaluate the effectiveness of neuro didactic approaches in teaching younger students. These studies provide valuable data on which methods have the greatest impact on the development of cognitive abilities and how individual differences among children affect their academic performance when using neurodidactic materials:

1. In a study conducted by Hoffman and Van Dijk (2018), the effectiveness of a neurodidactic approach based on cognitive exercises to enhance memory and attention in younger schoolchildren was assessed. In the experimental group, children participated in regular training that included tasks focused on working memory, logical thinking, and attention concentration. The results indicated a significant improvement in these cognitive functions among the children in the experimental group compared to the control group, which continued with a traditional curriculum. This confirms that the targeted use of neuro didactic materials contributes to the enhancement of cognitive abilities.

2. Another study conducted by Carson (2021) focused on the application of multisensory learning methods actively used in neurodidactic programs. Children participated in lessons that included visual, auditory, and kinesthetic stimuli simultaneously. The results showed that such lessons facilitate a deeper understanding and retention of material, particularly among children with diverse cognitive styles. Specifically, children with dominant visual and kinesthetic perceptions demonstrated the greatest progress, highlighting the importance of an individualized approach to learning.

3. Research by Blackwell and Duckworth (2016) emphasizes that individual characteristics of children play a crucial role in how they perceive and assimilate neuro didactic materials. In their study, younger schoolchildren with high levels of anxiety showed significant improvements in academic performance after participating in neuro didactic programs aimed at reducing stress and enhancing attention concentration. Conversely, children with higher initial cognitive functioning and no signs of anxiety experienced smaller, yet still significant, benefits from such programs.

4. Another interesting direction in neurodidactics involves the use of game methods and neurofeedback technologies. A study by Jenkins (2020) demonstrated that using gaming applications based on neuro didactic principles significantly enhances motivation for learning and improves cognitive metrics, such as working memory and problem-solving ability. Specifically, children using gaming neurodidactic applications exhibited higher engagement levels and better retention of educational material compared to traditional teaching methods.

5. A review study by Brown (2014), covering over 20 different studies, showed that neuro didactic methods are generally more effective than traditional approaches in teaching younger schoolchildren. The research highlights that the greatest effects are observed in areas related to the development of attention, memory, and creative thinking. However, studies indicate that traditional methods may be more effective in teaching basic academic skills, such as reading and arithmetic, especially in the early stages of education.

Based on the analysis of existing empirical research, it can be concluded that neurodidactic approaches hold significant potential for enhancing the cognitive functions of younger schoolchildren, particularly in areas such as attention, memory, and creative thinking. Methods that incorporate multisensory learning and gaming technologies show the most notable results, especially when adapted to the individual characteristics of students.

Individual differences, such as baseline cognitive function, levels of anxiety, and cognitive perception styles, play an important role in determining how successful the use of neuro didactic methods will be. This underscores the need for careful selection and adaptation of neuro didactic materials for each child, making this approach promising and relevant in the context of modern educational demands.

Contemporary educational research increasingly turns to neurodidactic approaches, which are based on understanding how the brain processes information and how these processes can be optimized for more effective learning. Comparing neurodidactic methods with traditional approaches allows for a deeper understanding of their advantages and highlights the limitations of traditional methodologies that neurodidactics can overcome.

One of the key advantages of neurodidactic methods is their ability to consider individual differences among students, such as cognitive style, baseline cognitive function, and emotional state. Traditional teaching methods often apply a one-size-fits-all approach, which can lead to situations where children with varying cognitive styles or emotional characteristics do not receive optimal learning conditions.

Students in traditional programs often face challenges related to low motivation and difficulty maintaining attention. In contrast, neuro didactic approaches, such as multisensory learning and the incorporation of game elements, promote greater student engagement and improve cognitive outcomes.

Unlike traditional methods that frequently focus on rote memorization and repetition, neuro didactic methods actively stimulate cognitive development through adaptive exercises. These exercises target the development of key cognitive functions, such as memory, attention, and problem-solving ability. Hoffman and Van Dijk's (2018) study showed that students engaged in neurodidactic programs exhibited significant improvements in working memory and attention tests, whereas students in traditional programs showed only minor progress.

Traditional teaching methods often impose a high level of cognitive load on students, which can lead to overloading working memory and decreasing learning effectiveness. Neurodidactics, on the other hand, focuses on reducing cognitive load by optimizing information delivery and utilizing principles from cognitive science, such as Sweller's (2016) cognitive load theory. For instance, Sweller and Chandler's (2015) study showed that students taught through traditional methods with high cognitive load often struggle to understand material, while the use of multimedia and visual aids proposed by neuro didactic methods significantly facilitates knowledge acquisition.

Traditional teaching methods frequently fail to account for students' individual needs, leading to decreased learning efficiency. Neurodidactic approaches, in contrast, offer adaptive techniques that align with each student's cognitive characteristics. Research in neuropsychology, such as Baddeley et al., (2015) work on working memory models, demonstrates that students with different cognitive styles can significantly improve their outcomes when learning is tailored to their needs.

Moreover, traditional methods often suffer from a lack of student motivation and engagement. Neurodidactics addresses this issue by incorporating gaming technologies and gamification elements, which have proven effective in several studies (Jenkins, 2020). These methods make learning more engaging and meaningful for students, enhancing material retention.

Another limitation of traditional methods is the difficulty in maintaining students' attention, particularly in early grades. Neurodidactics overcomes this challenge by employing techniques aimed at developing concentration and focus. For example, mindfulness practices, explored in Kabat-Zinn's (2018) work, have shown that regular use in educational programs significantly improves students' ability to focus on learning material.

Literature analysis indicates that neuro didactic approaches offer substantial advantages over traditional teaching methods, particularly in fostering cognitive abilities in younger schoolchildren. Key aspects, such as accounting for individual differences, reducing cognitive load, and enhancing motivation and engagement, make neurodidactics more effective compared to conventional approaches.

Furthermore, neuro-didactics is capable of overcoming several limitations inherent in traditional methods, such as insufficient adapta-

tion to individual needs, attention retention issues, and low student motivation. These advantages render neuro didactic approaches promising and relevant in the context of modern educational demands focused on developing intelligence and cognitive abilities in younger students.

Despite the many benefits, neuro didactic approaches face several challenges and limitations in their development and implementation. These factors need to be considered for the successful integration of neuro didactic methods into educational practice.

One of the main challenges in implementing neuro didactic approaches is the need for teacher training. Traditional teacher education often does not include training in the principles of neuropsychology, making the transition to new methods challenging. Research by Klimenko (2021) emphasizes that successful implementation of neuro didactic programs requires significant investments in professional development for educators. Teachers need to have not only basic knowledge of neuropsychology but also the ability to apply this knowledge in practice.

Neurodidactic approaches must be tailored for various age groups, requiring consideration of the cognitive development characteristics of each stage. For example, methods that are effective for older students may be too complex or ineffective for younger children. Johnson and Thompson (2016) highlight that age specificity is a key factor in the success of neuro didactic programs. Researchers point out the necessity of creating differentiated programs that take into account the age and cognitive characteristics of students.

Another important aspect is the adaptation of neuro didactic materials to different cultural contexts. Cultural differences can influence the perception and assimilation of educational content, making it essential to consider these factors when developing materials. For instance, research by Kim & Hwang (2016) shows that methods successful in one cultural context may be less effective in another if they are not adapted to the specifics of local culture and educational traditions.

While research in the field of neurodidactics continues to develop, there is still insufficient empirical data to conclusively confirm the effectiveness of all proposed approaches. As Cartwright (2020) notes, there is a need for longer and larger-scale studies that can provide more accurate data on the long-term effects of applying neuro didactic methods. Additionally, studies need to account for individual differences among students to better understand which methodologies are suitable for various categories of learners.

Despite the challenges mentioned, neurodidactic approaches present significant prospects for the educational system:

1. One of the key trends for the future is the development of personalized learning, where neuro didactic methods can play an important role. Research in artificial intelligence and adaptive learning (Brown, 2014; Wang, 2023) shows that technology can be used to create individualized learning paths that take into account each student's cognitive characteristics. Such approaches will help maximize the potential of every child by adapting educational materials and methods to their needs.

2. Technological progress also fosters the development of neurodidactics. The use of virtual and augmented reality, gaming technologies, and neurofeedback opens up new opportunities for creating interactive and engaging educational programs. For instance, research by Jenkins (2020) shows that using VR technologies allows students to immerse themselves more deeply in the learning process, which enhances memory retention and understanding of the material.

3. Neurodidactics has the potential to become an interdisciplinary field, combining the achievements of neuropsychology, pedagogy, cognitive science, and technology. In the future, we can expect an increase in research and practical programs where neuro didactic approaches will be integrated with innovations in educational technologies and developmental psychology. This interdisciplinary collaboration could lead to the creation of more effective and comprehensive educational programs that address not only

cognitive but also emotional and social aspects of student development.

The analysis of the existing literature highlights both the significant advantages of neuro didactic approaches and the challenges that need to be addressed for their successful implementation in educational practice. Key aspects to focus on include teacher training, adaptation of materials to age and cultural contexts, and the necessity for more extensive research.

Nevertheless, the prospects for the development of neurodidactics are impressive. Advances in technology, interdisciplinary collaboration, and growing interest in personalized learning create favorable conditions for the further evolution of this field. In the future, neuro didactics could become the foundation for creating more effective and individualized educational programs that enhance the cognitive development of younger students and improve their educational outcomes.

Moreover, the literature on neuro didactic content reveals not only the benefits but also a range of contradictions, shortcomings, and gaps that require further exploration and reflection.

There are conflicting data regarding the effectiveness of neuro didactic approaches compared to traditional teaching methods. Some studies demonstrate clear advantages of neuro-didactics, while others show no significant differences in student outcomes. For instance, research by Hoffman & Van Dijk (2018) claims that neuro didactic methods significantly improve cognitive functions such as attention and memory; however, Miller (2016) found no notable differences in memory test results between students taught using traditional methods and those taught using neurodidactic approaches. This discrepancy suggests a need for further investigation into the factors influencing method effectiveness and the contexts in which neuro-didactics are most effective.

There are also contradictions regarding the universality of neuro didactic methods. Some studies assert that these approaches can be universally applied across all age groups and cultural contexts, while others emphasize the need for adaptation. For example, Kim (2016) highlights the importance of culturally adapting materials, whereas some argue that neuro didactic principles can be applied in various cultural contexts without significant modifications. This indicates a need for a deeper exploration of the universality and adaptability of neuro didactic materials.

Limitations of Existing Research. 1. Many studies in the field of neurodidactics are based on limited sample sizes, raising questions about their representativeness and the ability to extrapolate results to a broader student population. The lack of large longitudinal studies makes it difficult to assess the long-term effects of neuro didactic methods on children's cognitive development. For example, most studies, such as those by Johnson and Thompson (2016), are constrained to the timeframe of a single academic year and do not consider long-term cognitive changes.

2. While neurodidactics is grounded in several neuropsychological theories, such as Sweller's cognitive load theory and Baddeley's working memory theory, it still requires a deeper theoretical foundation. For instance, the mechanisms through which neuro didactic methods impact various cognitive functions, such as critical thinking and creativity, are not well understood. Furthermore, there is a lack of research that integrates different theoretical approaches, which could contribute to a more cohesive and well-founded methodology.

Research Gaps in the Topic. 1. Most studies focus on the cognitive aspects of neuro-didactics, while the impact of these methods on the development of social and emotional skills remains insufficiently explored. For instance, neuro didactic methods may enhance emotional resilience and teamwork skills, but these findings require further validation and the development of specific methodologies for their implementation.

2. Although individual student characteristics are often mentioned as an important factor in neurodidactics, there is a limited number of studies that examine how these characteristics influence learning success in detail. Specifically, research is needed to explore how neuro didactic methods can be adapted for children with varying cognitive abilities, such as those with

developmental delays or special educational needs.

3. Most existing research is conducted within the framework of formal education, while the influence of neurodidactic methods on informal and supplemental education remains largely unstudied. For example, it is essential to investigate how these approaches can be applied in clubs, summer camps, and other informal educational settings.

Perspectives for Future Research. 1. Given the identified gaps and limitations, a promising direction may be the development of adaptive neurodidactic methods that consider both the cognitive and socio-emotional characteristics of students. For instance, creating individualized learning programs that dynamically adjust to the child's cognitive load and emotional state could significantly enhance learning effectiveness.

2. The future of neurodidactics lies in interdisciplinary research that integrates insights from neuropsychology, cognitive science, pedagogy, and educational technology. Such studies could facilitate the creation of new, more comprehensive methodologies that account for the full spectrum of cognitive, emotional, and social factors influencing learning.

3. To gain a deeper understanding of the long-term effects of neuro-didactics, longitudinal studies are needed to track the cognitive and emotional development of students over several years. This would reveal how neuro didactic methods impact students' long-term success and contribute to the development of sustainable skills and knowledge.

4. More comparative studies are necessary to examine the effectiveness of neuro didactic methods across different cultural and educational contexts. This would help tailor approaches and methods to the specific needs and characteristics of diverse student groups, making neuro didactics more universal and flexible.

A critical analysis of the literature reveals that while neuro didactic approaches hold significant potential, they also face several challenges and limitations. There are contradictions in assessing their effectiveness, issues with method adaptation, and a lack of theoretical foundation, all of which require further academic inquiry. However, the prospects for neurodidactics, especially in the context of interdisciplinary and adaptive research, position this field as one of the most promising areas in modern pedagogy.

48 primary school teachers from Almaty took part in the survey.

A survey was used to summarize the data. The questionnaire was given to determine the knowledge of primary school teachers about neurophysiological features, the development of intelligence of Primary School students, neuro didactic content, to determine what work they carry out in the development of intelligence of their students, and to clarify the content of neuro didactic content and determine the possibility of neuro didactic content in the development of students ' intelligence.

The content of the survey was as follows:

1. What are neurophysiological features?

2. Do you care about developing the intelligence of Primary School students?

3. what work do you do to develop the intelligence of your students?

4. What is Neurodidactic content?

5. Do you think Neurodidactic content has the potential to develop students ' intelligence? What if there is?

6. Determine the effectiveness of activities that affect the development of students ' intelligence:

Exercises for fine motor skills
Sports games
Breathing exercises
Role-playing games
Exercises for swimming
Exercises for movement
Group travel
Exercises for maintaining balance
Exercises for the eyes
Refreshing moments
Exercises for articulation
Drawing
Another.

In the output of the survey result, we used the variance of the arithmetic mean of the squares of the deviations of the given values from the arithmetic mean of the survey.

Results. 48 primary school teachers from Almaty took part in the survey. To determine their knowledge of neurophysiological features, the question «What are neurophysiological features?» the question was asked. As a result, out of 48 primary school teachers who answered this question, 16 of them answered 33.4% completely correctly, 21 of them answered only partially 43.7%, and the remaining 11 did not answer correctly 22.9%. The result of the question is shown in Figure 1.

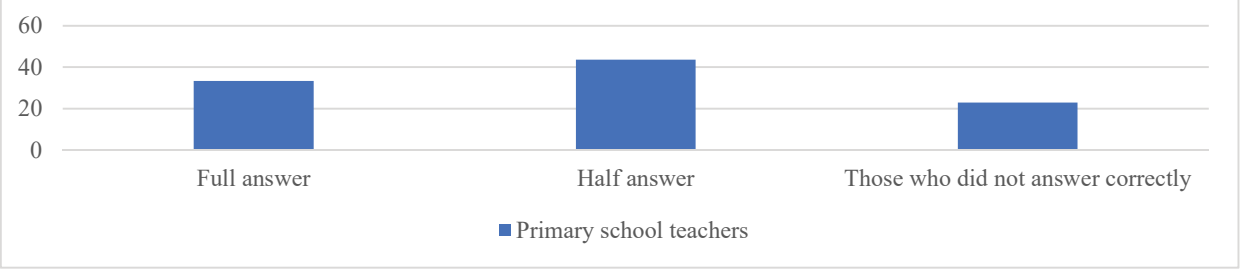

Figure 1: Result of Question 1 of the survey

To determine whether primary school teachers perform work on the development of the intelligence of their students in the educational process, it is necessary to ask the question: «Do you attach importance to the development of intelligence of Primary School students? Why don't you give it to me?» the question was given. While it was found that 87% of teachers pay attention to the development of intelligence in their students, 32% noted the lack of special hours for the development of intelligence, 46% noted the lack of a special elective course, 14% noted the lack of special educational and methodological complexes, 8% noted the limitation of time in the lesson. The result of the question is shown in Figure 2.

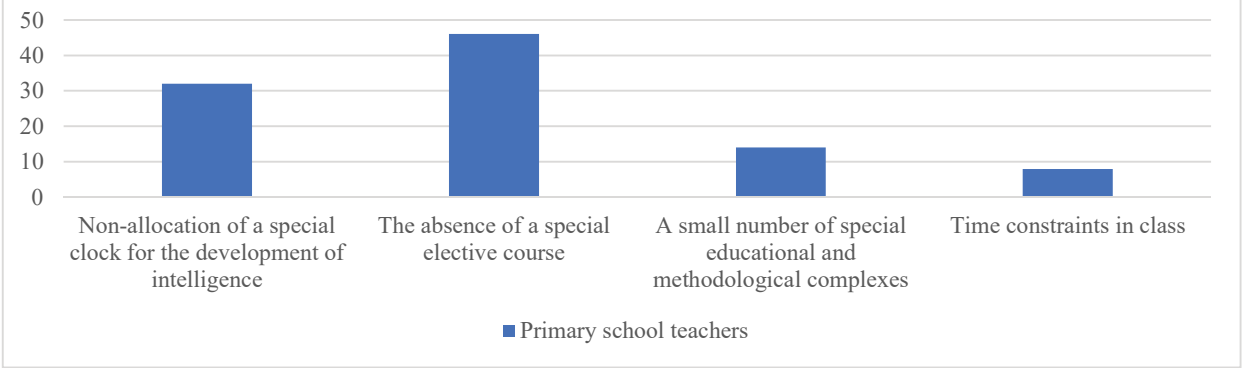

Figure 2: Result of Question 2 of the survey

To determine what work teachers, do in the development of the intelligence of Primary School students, it is necessary to ask the question: «What work do you do in the development of the intelligence of their students?» the question was given. As a result, 48% of the respondents showed that they use Psycho-diagnostic methods, 14% artificial intelligence, 19% logical tasks, 6% neuroleptics, and 13% didactic games. The result of the question is shown in Figure 3.

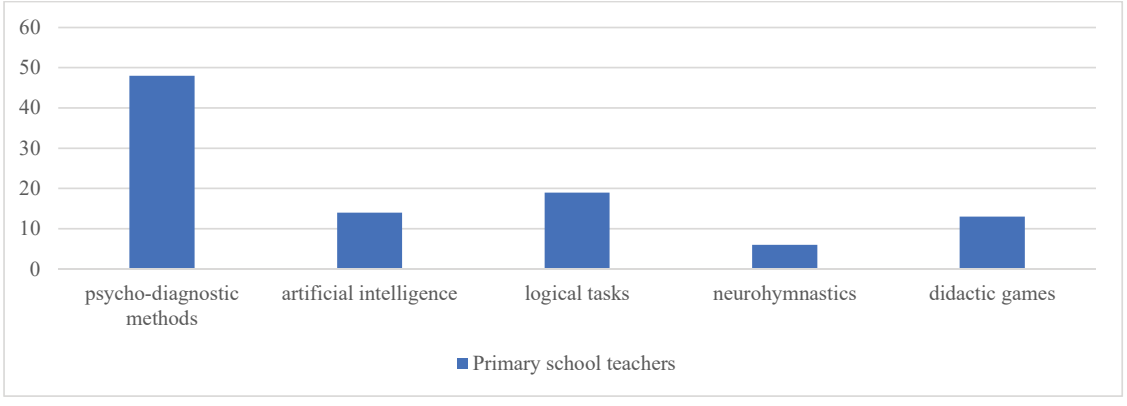

Figure 3: Result of Question 3 of the survey

To determine the participants ' knowledge of neurodidactic content, the question «What is Neurodidactic content?» the question was asked. As a result, 21% of respondents answered this question completely correctly, 38% wrote only partially, the remaining 24% did not answer correctly, and 17% did not answer. The result of the question is shown in Figure 4.

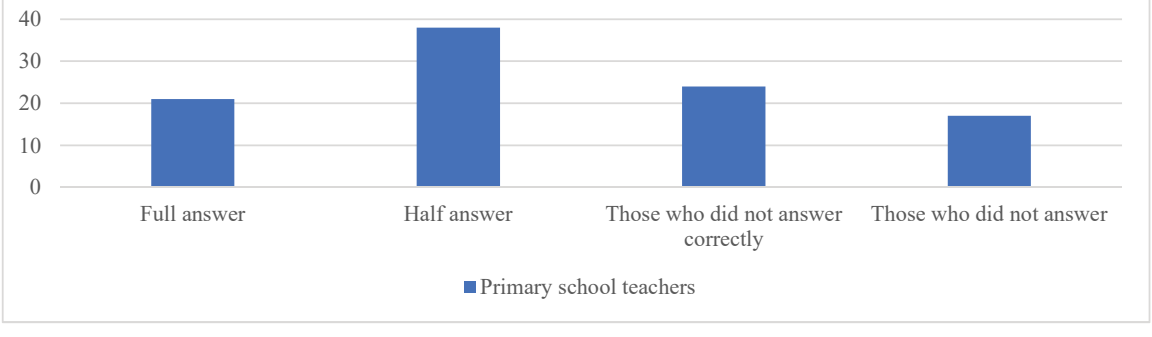

Figure 4: Result of Question 4 of the survey

To determine what potential neurodidactic content has in developing students ' intelligence, teachers are asked, «Do you think Neurodidactic content has in developing students' intelligence? What if there is?» the question was asked. As a result, teachers showed that 100% of neuro didactic content has a very high chance of developing students ' intelligence. As an opportunity for neuro didactic content, 23% of teachers identified the development of fine motor skills, 21% breathing, 24% movement, 15% articulation, 5% memory, 8% imagination, and 4% speed reading. The result of the question is shown in Figure 5.

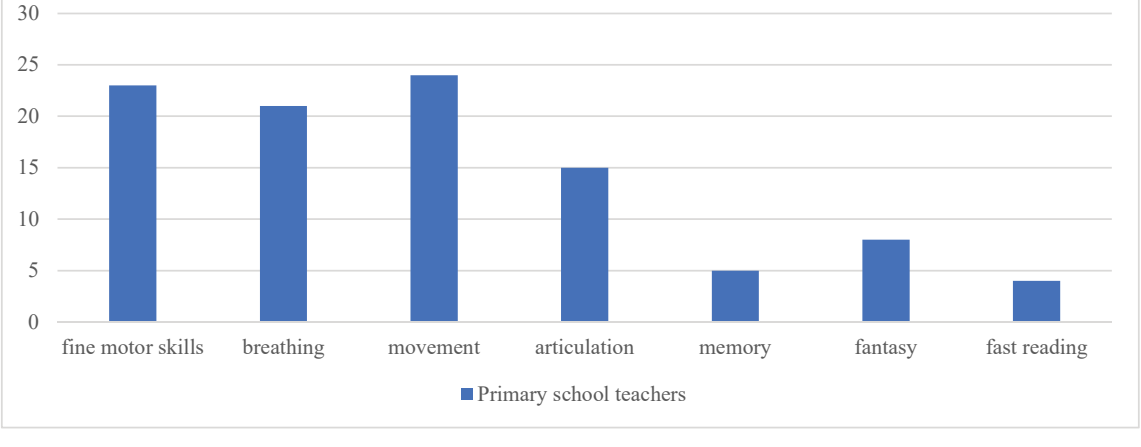

Figure 5: Result of Question 5 of the survey

To determine the effectiveness of activities that affect the development of students ' intelligence, teachers are advised to «establish the effectiveness of activities that affect the development of students' intelligence: exercises for fine motor skills, sports games, breathing exercises, role-playing games, swimming exercises, exercises for Movement, group travel, exercises for maintaining balance, exercises for the eyes, toning moments, exercises for articulation, drawing,..» the question was given. The result is presented in *Table 1.*

Table 1. *Result of question 6 of the survey*

№	Answers	%
1	Exercises for fine motor skills	86
2	Sports games	32
3	Breathing exercises	79
4	Role-playing games	21
5	Exercises for swimming	5
6	Exercises for movement	93
7	Group travel	14
8	Exercises for maintaining balance	97
9	Exercises for the eyes	89
10	Refreshing moments	23
11	Exercises for articulation	92
12	Drawing	16
13	Another...	9

Let's check the effectiveness of activities that affect the development of students ' intelligence in the given table. To do this, let's calculate the arithmetic mean of the squares of deviations of the values given in the table from the arithmetic mean using the variance. We calculate it using the following formula.

$$r^2 = \frac{\sum_{i=1}^{n} n_i (n_i^* - M)^2}{n}$$

Table 2. *Variance and standard deviation of events affecting the development of students ' intelligence*

№	Events X_i	% n_i	$\overline{M}$	X_i^*	$\left\|X_i^* - \overline{M}\right\|^2$	$r^2 = \frac{\sum_{i=1}^{13}(X_i - M)^2}{13-1}$	r
1	Exercises for fine motor skills	86	50,46	35,54	1263,092	1460,76	$r = \sqrt{1460,76} \approx 38,21$
2	Sports games	32	50,46	-18,46	340,7716		
3	Breathing exercises	79	50,46	28,54	814,5316		
4	Role-playing games	21	50,46	-29,46	867,8916		
5	Exercises for swimming	5	50,46	-45,46	2066,612		
6	Exercises for movement	93	50,46	42,54	1809,652		

7	Group travel	14	50,46	-36,46	1329,332
8	Exercises for maintaining balance	97	50,46	46,54	2165,972
9	Exercises for the eyes	89	50,46	38,54	1485,332
10	Refreshing moments	23	50,46	-27,46	754,0516
11	Exercises for articulation	92	50,46	41,54	1725,572
12	Drawing	16	50,46	-34,46	1187,492
13	Another...	9	50,46	-41,46	1718,932

In conclusion, it was possible to conclude that most of the given results are located at intervals equal to +38.21 from the arithmetic mean, that is, exercises for fine motor skills, exercises for breathing, exercises for movement, exercises for maintaining balance, exercises for articulation have a positive effect on the development of students ‘ intelligence.

Discussion. The first question of the questionnaire concerned the assessment of teachers ‘ knowledge about the neurophysiological characteristics of the child. As a result, we found that primary school teachers have incomplete knowledge and concepts about the neurophysiological characteristics of students. This is still a lack of special courses, educational and methodological complexes, and modern ideas about the neurophysiological features of Primary School students, about the development of their intelligence through neurodidactic content.

Summing up the answers to the first question, it became necessary to organize an advanced training course for primary school teachers to replenish the knowledge of teachers about the neurophysiological characteristics of students. From the answers of the teachers on the second question of the questionnaire, it was found that although they had attempted to develop the intelligence of Primary School students, the lack of allocation of a special hour for the development of intelligence and the limitation of time hindered. In this regard, the need for the organization of an elective course «neurofeedback» specifically for the educational process of primary school has been identified.

As a result of the answers to the third question of the questionnaire, we found that teachers use special psychological test methods that are used in the development of the intelligence of their students. It has been observed that the possibilities of neuro didactic content are not taken into account and are not used in the development of students ‘ intelligence.

The fourth question of the survey concerned teachers ‘ knowledge of neuro didactic content. As a result, most teachers showed a low level of knowledge about «neuro didactic content». That is, this increased the meaning of the organization of advanced training courses for teachers to develop the intelligence of Primary School students through autodidactic approaches.

According to the results of the answers to the fifth question of the questionnaire, teachers believe that autodidactic content has the potential to develop students ‘ intelligence, but indicates insufficient knowledge in the use of ways and methods of its use in the educational process, that, incomplete knowledge was revealed.

The results of the last question of the survey made it possible to identify activities that affect the development of students ‘intelligence: most teachers emphasized the importance of exercises for the development of fine motor skills, breathing, vision, movement, and articulation as activities that effectively affect the development of students’ intelligence. As a result, the following types of exercises aimed at developing students ‘ intelligence were identified: exercises for fine motor skills, exercises for breathing, exercises for movement, exercises for the eyes, and exercises for articulation.

Conclusion. In this research work, the problems of neurodidactics considered in the works of foreign and Kazakh researchers were studied, and the theoretical foundations of neurodidactics were studied, including the concepts of neuroplasticity and cognitive development. As a result of the study, the advantages and unique opportunities of autodidactic approaches over traditional teaching methods were revealed. At the present stage, one of the main tasks is the use of innovative approaches to develop the intellectual abilities of Primary School students. In this context, neuro didactics, a direction based on the integration of data from neuropsychology and pedagogy, becomes of particular importance. In this regard, the importance of using neuro didactic content as one of the methods aimed at activating the cognitive processes of children, such as memory, attention, and thinking, contributing not only to the successful assimilation of educational material but also to the general intellectual development, has been established.

To identify the possibilities of autodidactic content in the development of intelligence of Primary School students, a survey was conducted. The results of the study indicate the need to create and implement an educational program of a refresher course on the topic «Development of intelligence of Primary School students through autodidactic approaches» for teachers of primary education, one of the main tasks of which is to improve the knowledge of teachers about the neurophysiological features of the child and their relationship with intelligence. The information obtained in the course of the study made it possible to determine the need and content of the organization of an elective course «Neurohymnastics» specifically for the educational process of Primary School to supplement knowledge about the features of the development of the child's brain and develop intelligence.

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