

## Investigating the Effects of Cognitive and Physical Development in Children Education

### Investigando los efectos del desarrollo cognitivo y físico en la educación infantil

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**Received** 12-01-19 **Revised** 02-01-20 **Accepted** 02-22-20 **On line** 03-11-20

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#### Cite as:

Zakharova, V. S., Maydankina, N. Y., & Zakharova, L. M. (2020). Investigating the Effects of Cognitive and Physical Development in Children Education. *Propósitos y Representaciones*, 8(2), e475. Doi: <http://dx.doi.org/10.20511/pyr2020.v8n2.475>

## Summary

The article considers the relationship of physical and cognitive development of children as well as the processes of memory and attention. They determine the readiness of a child for school education. The analysis of existing theories made it possible to single out the conditions for their development. There was conducted a study to check the level of memory and attention development of 6-7-year-old children. Diagnostic results showed that the vast majority of children showed an average level of memorization, and a low level of attention development. The results of the diagnosis confirmed that the features of the mental development of the preschoolers do not allow a child to fix attention on subjects or actions for a long time, to maintain interest in the performed action. Physical development of children is at the average level. Unified patterns between the general level of mental development and the development of certain types of movements were revealed. Specially organized physical activity for children with a selection of exercises that require concentration of attention, memorizing patterns of movement, coordination will contribute to the development of memory and attention.

**Keywords:** Physical Development; Memory; Attention; Exercise; Preschool Children.

## Resumen

El artículo considera la relación del desarrollo físico y cognitivo de los niños, así como los procesos de memoria y atención. Determinan la preparación de un niño para la educación escolar. El análisis de las teorías existentes permitió identificar las condiciones para su desarrollo. Se realizó un estudio para verificar el nivel de memoria y el desarrollo de la atención de niños de 6 a 7 años. Los resultados del diagnóstico mostraron que la gran mayoría de los niños mostraron un nivel promedio de memorización y un bajo nivel de desarrollo de la atención. Los resultados del diagnóstico confirmaron que las características del desarrollo mental de los niños en edad preescolar no permiten que un niño fije la atención en temas o acciones durante mucho tiempo, para mantener el interés en la acción realizada. El desarrollo físico de los niños está en el nivel promedio. Se revelaron patrones unificados entre el nivel general de desarrollo mental y el desarrollo de ciertos tipos de movimientos. La actividad física especialmente organizada para niños con una selección de ejercicios que requieren concentración de atención, memorizar patrones de movimiento, coordinación contribuirá al desarrollo de la memoria y la atención.

**Palabras clave:** Desarrollo físico; Memoria; Atención; Ejercicio; Niños de preescolar.

## Introduction

The study of the effects of various factors on the development of children is determined by several reasons. They are the comprehensive development of each child, the need to prepare a child for school education that includes general and special readiness, as well as the appropriateness of using different methods of education.

General readiness is characterized by the level of physical development associated with the development of basic physical qualities (speed, coordination, dexterity, strength), the level of development of basic movements (running, jumping, squats, inclines, etc.), the development of fine motor skills. General readiness of a child for school is also associated with the development of cognitive abilities, emotions, will power and social skills.

Readiness for school is not considered only as a specially organized activity for the development of certain universal educational skills (how to count, write, accept and set tasks). In a preschool organization, readiness for school is ensured by the integrated approach to the implementation of all educational activities, creating conditions for the personal development of

a child, considering his abilities and capabilities. Educators in preschool organizations develop integrated tools that provide a comprehensive development of personality traits.

Cognitive (psychic) abilities are the highest functions of the brain. They include understanding, thinking, spatial orientation, learning, speaking, etc. The development of cognitive abilities is determined by the development of memory and attention.

There is no unified theory regarding the nature of memory, the explanation of how the process of memorization occurs, what factors influence it and the process of forgetting does not exist. Representatives of different theories explain them differently. There can be distinguished psychological and physiological foundations of existing theories of memory.

According to the associative theory (H. Ebbinghaus), memory is considered as a complex system of short-term and long-term stable associations (paying attention to adjacency, similarity, contrast, etc.). From the standpoint of the Gestalt theory, it is necessary to structure the material, to systematize it when memorizing and reproducing it.

Cognitive psychology determines the decisive role of knowledge, cognitive structures in the course of mental processes and human behavior. The questions of knowledge organization in human memory, the ratio of verbal and figurative components in the processes of memorization are studied. Representatives of this direction do not study behavioral reactions like behaviorists, but they do study internal mental processes and cognitive ones. The sources of cognitive theory are viewed in philosophical concepts of cognition and are associated with the tasks of adaptation to the environment (Romanova, 2008).

According to the activity theory of memory (A.N. Leontyev, P.I. Zinchenko, A.A. Smirnov, etc.), memory acts as a special type of psychological activity that includes the system of theoretical and practical actions that are subordinate to solving a mnemonic problem (storing, saving, reproducing information) (Nemov, 2003).

Physiological theories of memory are based on the ideas of I.P. Pavlov and the laws of higher nervous activity. The material basis of memory is the neuroplasticity of the cerebral cortex, its ability to form conditioned reflexes. The physiological basis of memory is the formation, strengthening and fading of temporary nerve connections. Moreover, both short-term memory and long-term memory have completely different physiological mechanisms. Short-term memory is associated with the functioning of closed neural circuits. The stability of long-term memory to such strong external influences is associated with stable biochemical changes in neurons and synapses (Soloviev, 2006).

Various developmental problems and memory features were studied by L.I. Bozhovich, L.S. Vygotsky, L.V. Zankov, A.N. Leontiev, V.S. Mukhina, D.B. Elkonin and others. Scientists studied those brain mechanisms that ensure the preservation of past impressions, they proved that memory is associated with various aspects of cognitive activity and is not a separate ability (Soloviev, 2006). Memory is an indicator of the state of many mental processes, reflecting the characteristics of the development of mental functions and the functional development of the brain.

The study of different theories of memory allows us to identify factors that affect the course of memory processes, especially conservation as the activity of the individual, the understanding of the memorized material, reliance on visibility.

The study of attention causes some difficulties due to the fact that there is no complete clarity in understanding what category "attention" refers to: functions, processes or states.

According to P.Ya. Galperin, attention is not a proprietary product; and it is difficult to indicate the content of the process of attention (Romanova, 2008).

L.C. Vygotsky considers attention in the framework of cultural and historical theory. D.N. Uznadze studies attention from the standpoint of the psychology. According to B.M. Teplova, attention is the orientation of consciousness at a specific object (Teplov, 1953). The focus is on the law of induction of nervous processes, according to which the focus of excitation that occurs in the cortex of the hemisphere causes inhibition of the surrounding areas. (I.P. Pavlov).

According to the activity approach, attention is defined as “the focus and concentration on any activity” (B.G. Ananyev, F.N. Gonobolin, N.F. Dobrynin, S.Ya. Rubinshtein, I.V. Strakhov). Moreover, attention is not an independent process, but only a manifestation of other processes. P.Ya. Galperin defines attention as "a special control activity."

Most psychologists consider stability, volume, and concentration to be the most important properties of voluntary attention. Attention plays a significant role in the regulation of cognitive activity and mental processes at all stages of individual development. Attention is always included into the activity, it is the main condition for its productivity and acts in conjunction with such mental processes as cognitive, volitional, emotional.

Researchers are increasingly paying attention to the relationship between the physical and mental development of children, the advantages of physical activities in intellectual development, and the improvement of cognitive processes. First of all, a child learns the capabilities of his body, masters the methods of performing exercises, develops sensory abilities. A child develops ideas about time, space, speed, accuracy, dexterity, etc. Incorrect execution of movements and lack of solutions to the motor task involve understanding the reasons for the failure and searching for the correct answers (Shcherbakova, 2011).

The purpose of the study is to identify whether there is a relationship between the level of physical development of children and the development of memory and attention.

## Method

In order to study the arbitrary memorization of 6-7-year-old children there was performed the test "Remembering 10 words". Normally, 3-5 words are reproduced after the first presentation and 8-10 words are recalled after the fifth one. The sample consisted of 159 children from urban and rural kindergartens. To assess the switchability and distribution of attention, there was applied the “Put down the badges” test (Pieron-Ruzer technique). The sample consisted of 146 children. Before completing the assignment, every child received the instructions. In each of the squares, triangles, circles and rhombs it was necessary to put down the sign that was set at the top of the sample, that was, correspondingly, a check mark, a dash, a plus or a dot. Children worked continuously, completing this task during 1 or 2 minutes, and the overall rate of switching and distribution of his attention was determined by the formula:  $S = (N - 2.8n)/t$ ; S is the indicator of switching and distribution of attention; N is the number of geometric figures viewed and marked with corresponding signs during the task; t is the time during which the figures were viewed; n is the number of errors made during the execution of the task.

## Results

Diagnostic results showed that children have a fairly good level of development of memorization. 48 children (30.2%) were diagnosed to have a high level, 95 children (59.8%) had an average level, 12 children (7.5%) had a level below the average, and 4 children (2.5%) had a low level. There were no particular differences in the process of memorization by children from rural and urban kindergartens. The overwhelming majority of children were with an average level of memory development (10-12 people). The total average productivity of memorizing a list of words was 7 units. After the first

presentation, an average of 4.1 words is reproduced, which is generally normal. Delayed playback is 7.1 units, which is slightly below normal.

Analysis of the diagnostic results showed that 9 children (6.16%) had a high level of attention and 19 children (13.01%) had the average one. 67 children had their attention at a rather low level of development and 67 people have shown a very low level of switchability and distribution of attention.

The results of the diagnosis confirmed that the features of the mental development of preschoolers do not allow children to fix attention on the subject or action for a long time, to maintain interest within the performed action. This is largely due to the psychological characteristics of children, the development of randomness of attention. During the preschool age, there is a process of improving attention; its volume increases, there appear some elements of randomness.

How can we develop memory and attention? What resources in their development are inherent in various types of activities? What about the physical one? Is there any correlation between the level of physical development and the level of development of cognitive abilities? Is there any correlation between specific types of exercises and mental processes? Is it possible to distinguish special types of movements, physical exercises that provide the opportunity for the development of attention and memory?

To answer these questions, there were conducted comparative studies between two (physical and mental) indicators of children's development.

At the beginning of the year, a diagnosis was carried out to identify the level of physical development of children, which involved determining the nature and accuracy of physical exercises, as well as developing speed, when performing shuttle running (30 meters). Execution time was 10.5 seconds for boys, and 11 seconds for girls. Also the studies paid attention to force when throwing a stuffed ball, kicking the ball, performing long jumps from a place and doing balance exercises, etc.

In general, 6-7-year-old children have fairly good indicators of physical development. Among 58 pre-school children, 24 children had a high level of physical development (41.38%), 33 children had an average level (56.9%), and 1 child had a low level (1.72%). In order to identify patterns between mental processes and indicators of physical development, there was compiled a correlation lattice with an indication of the correlation coefficient, that is an indicator of the linear relationship between the two indicators (table 1).

The correlation coefficient is calculated using the equation:

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

, where x and y are variables (indicators of mental and physical development of children).

The correlation coefficient varies from minus one to plus one, which can be interpreted as:

- option 1. Presence of a direct connection (values close to one);
- option 2. Lack of connection (values close to zero);
- option 3. Presence of feedback (values close to minus one).

During the study there were established the stable functional connections of various strengths between voluntary behavior and physical fitness ( $g = 0.536 - 0.768$ ), random behavior and mental processes ( $g = 0.652 - 0.674$ ). They provide a basis for recognizing the relationship between the development of motor abilities, mental processes and quality of behavior control.

Analyzing the obtained data of two age groups of senior preschool children (No. 12 and No. 13), we can talk about the revealed uniform patterns between: the general level of mental development and the development of balance; general level of mental development and long jumps from a place. A strong and medium direct connection was also revealed within group 12 between: attention and beating the ball, memory and short rope jumping, memory and long jumps, memory and balance development (see table 1).

**Table 1.**

*Relationship between physical and cognitive development of children*

indicators	attention	memory	speech	general level of mental development
Long jumps	0, 356348	0, 53452	0, 16666	0, 408248
Rope jumps	0, 534522	0,801784	0, 25	0, 408248
Balance	0,35634	0, 53452	0, 58333	0, 40824
Crawling on the gym bench	0,089087	0,08909	0,16667	0,40825
Hitting the ball	0,65465	0,21821	0	0,2

## Conclusion and Suggestions

The obtained data suggest that there is some relationship between the development of attention, memory and a specific group of physical exercises. Considering the heterochronism of the development of motor abilities during the preschool age (N.A. Notkina), we determined groups of exercises, the development of which is largely due to the development of memory and attention, and which, in turn, contribute to their development. They are the *endurance exercises*: running for 2 minutes with a change of direction, continuous jumping in place and in movement for 15, 20, 30 seconds, cycling, walking at distances of up to 1 km; training on simulators; *speed-strength exercises*: shuttle run 3x10, 3x20; jumping through hoops that lie at a distance of 40-50 cm; throwing a weighted small ball; pushing a stuffed ball; *coordination exercises*: walking on a limited surface, games designed to change movements or directions of movements, games for balance.

Performing these exercises contributes to improving the functioning of the whole organism, its systems (respiratory, digestive, cardiovascular, nervous); it increases blood flow to organs and systems. During physical activities, the neurotrophic factor of the brain rises, it is located in those parts of the brain (hypocam) that are important for memory and thinking. The neurotrophic factor takes part in maintaining the life of existing neurons and is involved in the formation of new neurons and synapses; therefore, its higher level is associated with an improvement in cognitive processes. A higher level of brain neurotrophic factor, which is caused by exercise, leads to a higher degree of brain neuroplasticity, which in turn is associated with a higher level of learning and cognitive abilities (Cotman & Berchtold, 2002).

In our opinion, a specially organized physical activity with a selection of exercises that require concentration of attention, memorizing patterns of performing movements, coordination, contributes to the development of memory and attention.

In this regard, it is advisable to organize a closer interaction between a psychologist and a PE educator and to apply the results of psychological diagnostics to adjust the educational work with children.

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