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ASSESSMENT OF COGNITIVE ABILITIES OF ADOLESCENTS

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Abstract. *To study the impact of physical exertion on the psycho-emotional state of adolescents aged 11–14 years who are engaged in karate sections. There were examined 14 adolescents aged 11–14 years, who have been engaged in Koshiki Karate-Do for three years. The assessment of the cognitive abilities of adolescents was studied according to the data of Landolt's correction table. The analysis of the impact of physical exertion on the cognitive abilities of adolescents aged 11–14 years according to the data of the correction test showed an increase in the level of endurance in the examinees by almost twice. Physical exertion caused an increase in the percentage of teenagers with a high level of endurance and, accordingly, a decrease with a low one.*

Keywords: *cognitive abilities, physical exertion, teenagers, mental performance.*

Introduction.

Modernization of the education system puts forward many new and higher requirements, but the growing psychophysiological "price" of education leads to the fact that the psychophysiological resources of students are identified to be insufficient or exhausted. In today's learning environment, preparing students for intense mental activity is of crucial importance for the assimilation of the material, which constantly increases. This is especially important for high school students, primarily due to the increase in the number of compulsory subjects and, accordingly, the time for completing tasks, which leads to a decrease in physical activity. Despite the practical significance of this problem and the urgency of its solution, there are no specially oriented studies in the scientific literature aimed at studying the peculiarities of the cognitive functions of high school students and the importance of taking them into account during the construction of the educational process [1, 3].

Cognitive activity is the most complex function of the brain, the process by which we rationally perceive the world and purposefully interact with it. This process includes the perception, processing, analysis, retention and exchange of information, as well as the construction and execution of programmed behaviour. Each of the listed stages of cognitive activity performs a certain function.

The analysis of scientific-methodical and professional literature on the problem of individualization of the process of physical education of students shows that school physical education does not adequately develop physical qualities of the young people. Modern parents, who understand the importance of physical activity for the normal development of their children, are looking for various after-school sports clubs. Today, the sports services market offers a wide selection of different disciplines [1, 2, 4, 5].

Karate is one of the modern and attractive sports for young people. This direction is developing rapidly, and today it is a widely recognized sport due to its dynamism, variety, systematization and fun. Despite the large amount of data concerning the effect of training on the functional state of various systems, there are not enough studies regarding the effect on the functioning of the central nervous system. However, there are data that moderate physical activity can contribute to the increase of a mental activity. Scientists have proven that physical exercises have a positive effect on a person's mental abilities and stimulate mental activity [5]. Therefore, the correct choice of load is the basis of physical education. The educational program must take into account the laws of physical development, its sensitive periods, individual functional capabilities of the students-adolescents, anatomical and physiological features, differentiation and gender approach. Only such an approach can solve one of the main tasks of physical education of the students-adolescents in the process of mass physical education: strengthening the physical and mental health of the younger generation.

The research was carried out in accordance with the scientific topic of the Department of Physical Rehabilitation, Biology and Health Care of K.D. Ushynskyi South Ukrainian National Pedagogical University, "Assessment of individual health and improvement of adaptation capabilities of children and youth by means of health-preserving educational technologies" (state registration number 0120U002012).

Purpose of work: to study the impact of physical exertion on the psycho-emotional state of adolescents aged 11–14 years who are engaged in karate sections.

Research materials and methods. The research was conducted on the basis of the Club "OXY GYM" in the city of Odesa. There were examined 14 adolescents aged 11–14 years, who have been engaged in Koshiki Karate-Do for three years. The training period ranged from 5 to 17 months. All persons participated in the examination with the consent of the parents and in presence of the trainer. Before the beginning of the study, every parent and teenager were informed about the sequence of the examination and they were explained about the methodology.

The assessment of the cognitive abilities of adolescents was studied according to the data of Landolt's correction table. Before starting the test, the examinee was given a form with rings with a gap in one of eight directions: at 13, 15, 17, 18, 19, 21, 23, 24 hours, if you focus at the clock face. The examinee must read the lines of the form from left to right (as if reading a book), without missing a single one, and cross out the rings with a gap of 12 hours. It is necessary to work at the maximum pace. The examinee first fills in the test line and then starts working. After every 2 minutes, the command "dash" is given, according to which the examinee must put a vertical dash after the last viewed ring and continue working without stopping. After 10 minutes, the command "stop" is given, after which the last viewed ring is highlighted. It is necessary to work as quickly as possible and not make mistakes. The total time for the correction test is 10 minutes.

Based on the obtained calculations of revised, crossed-out rings, taking into account errors (missed and mistakenly crossed-out figures), the following values were found: accuracy of work performance, work productivity every 2 minutes, information processing speed (S), average work productivity indicator for 10 minutes (Pt), endurance coefficient (Kp), index of average accuracy of work in 10 minutes (At), accuracy coefficient of the performed work. Examinations were conducted twice: before and after karate training.

The obtained data were subject to statistical processing using Excel and SPPS 16 software.

Research results and their discussion. Starting to interpret the results, first of all, it is necessary to understand clearly that in this case we are measuring the performance of the nervous system, that is, the basic, primary performance which is the basis of any activity. The features of this basic performance are manifested in the research indirectly, through activity which essence consists in the perception and processing of information in accordance with certain rules. What kind of "volitional effort" the human nervous system is capable of, how long it can work without getting tired, the effectiveness and style of not only professional activity, but also the entire life of a person as a whole will depend on it.

The information processing speed indicator (S) indirectly characterizes the functional mobility of the nervous system – the speed of propagation of nerve impulses, as well as their mutual transformation (change of excitation by inhibition, or vice versa). The speed of movement of the nerve impulse is directly related to conditioned reflex behavioural activity. The results of tests of the adolescents aged 11–14 years showed that the majority of the examinees (65%) had a high speed of information processing, 25% had a speed of information processing higher than the average one, and only 10% of teenagers had an average speed of information processing. At the same time, it is shown that the increase in the speed of information processing was not always accompanied by a higher quality of work. Thus, the examinees with an average speed of information processing made more mistakes than the individuals with a high level. However, fewer errors were registered with the adolescents with a level of information processing speed higher than the average one ($p > 0.05$).

Average work accuracy, according to some authors, is similar to a complex visual-motor reaction and characterizes a person's ability to differentiate inhibitory and positive stimuli; reflects the strength of nervous processes in the central nervous system and determines a person's ability to perform tasks without errors. The analysis of the obtained data on the average accuracy of the work of the adolescents aged 11–14 years showed a higher percentage of examinees with a high level of the studied criterion. It should be noted that the higher was the level of accuracy of the performed work, the fewer mistakes were made by the respondents, which confirms the above-mentioned

statements of the scientists. That is, the examinees who showed a high level of work accuracy, made from 16 to 38 errors in 10 minutes, compared to the individuals with a low level, who showed 58-116 missed and incorrectly crossed out rings.

According to the criterion of the average performance of the performed work by the examinees in the group, a level of value above the average was registered, while individual data indicated a different dynamic. Thus, 55% of the examinees had an average level, 35% had a low level, and only 10% of girls had a level above the average one.

Determination of a person's ability to maintain a level of productivity for a long time without signs of fatigue was carried out using the endurance coefficient, which indicates the resistance of nerve cells to the action of a stimulus, while characterizing the strength of the nervous excitatory process. So, the research revealed a high level of endurance of the half of the examined teenagers. The other half had a low level. It is interesting that a greater number of errors were observed in individuals with a low level of endurance, which indicates the instability of the functioning of the central nervous system of the adolescents.

Also, the coefficient of accuracy of the performed work, which showed an increase in fatigue in 60% of the examinees, indicates the instability of the nervous system of adolescent athletes. It determines a person's ability to a long-term maintenance of the identified level of accuracy of work without signs of fatigue, reduces infallibility of work. Similar to the endurance coefficient, the accuracy coefficient characterizes the endurance of a person, but from the point of view of maintaining the infallibility of the activity.

Therefore, the analysis of the obtained data concerning the mental performance of karate athletes aged 11–14 years according to E. Landolt's correction test revealed a decrease in the accuracy and endurance of the work at a high speed of its execution in most of the examinees.

The study of the influence of karate classes on the cognitive abilities of the examinees revealed multidirectional dynamics. Thus, the speed of information processing among teenagers increased significantly, which was evidenced by the

greater number of rings viewed by the examinees in 10 minutes of work. By the number of viewed rings, it is possible to estimate the integral psychophysiological characteristic of adolescents, which is general working capacity. That is, doing sports was characterized by a reliable significant increase in mental capacity (10.36%), which indicates a positive effect of physical activity on the central nervous system of the examinees.

It should be emphasized that the increase in the speed of processed information was accompanied by a decrease in errors both on average for the group and for the levels. Therefore, the volume and quality of work performed by adolescents, as important psychophysiological characteristics, reveal a positive dependence on physical exertion. In addition, performing a correction test after physical exertion caused an increase in the speed of processed information in 80% of the examinees, which also indicates an improvement in the functional state of the central nervous system of most athletes.

The study of the average work accuracy revealed an unreliable post-work increase of this criterion in the respondents in the range of 8.91% and varied from a low to a high level.

Therefore, the analysis of the impact of physical exertion on the cognitive abilities of adolescents aged 11–14 years according to the data of the correction test showed an increase in the level of endurance in the examinees by almost twice. Physical exertion caused an increase in the percentage of teenagers with a high level of endurance and, accordingly, a decrease with a low one.

Conclusions.

1. Most of the examined (65%) had a high speed of information processing, 25% had a speed higher than average one, and only 10% of teenagers had an average speed of information processing. Under the influence of training, the speed of information processing increased significantly, which was evidenced by a greater number of rings viewed.

2. Physical exertion was accompanied by an increase in the volume and quality of the performed work, which was characterized by a decrease in the number of missed

and incorrectly crossed out signs and an increase in reviewed rings.

3. It was determined that physical exertion in the form of training during karate classes contributed to an increase in the level of average accuracy and productivity of performed mental work among adolescents aged 11–14 years according to the correction test.

4. There was registered an increase in the percentage of examinees with a high level of endurance after physical exertion. However, according to the coefficient of work accuracy, an increase in fatigue of the nervous system was observed in 60% of respondents both before and after physical exertion.

References.

1. Barabash O. Yu. (2011). The environmental aspect of the development of cognitive abilities of schoolchildren. *Science and education*, 9:16–19.

2. Blystiv T. (2018). The state of cognitive functions of high school students as a basis for building a program of health and recreational classes. *Youth scientific bulletin of Lesya Ukrainka East European National University. Physical education and sports*, 31:17-24.

3. Burov O. Yu. & Pinchuk O. P. (2023). A meta-analysis of the most influential factors of the virtual reality in education for the health and efficiency of students' activity. *Educational Technology Quarterly*, 2023 (1): 58–68. https://doi.org/10.55056/etq.435

4. Prokhorenko L.I., Babyak O.O., Batasheva N.I. at all. (2020). Education of children with disorders of cognitive development under the conditions of the competence approach: educational and methodological manual. Kyiv: Mykola Yarmachenko Institute of Special Pedagogy and Psychology of the National Academy of Sciences of Ukraine.

5. Chernyshov V. (2020). Psychological and cognitive characteristics of candidates for drivers: age and gender aspect. *Science and Education a New Dimension. Pedagogy and Psychology*, VIII (95), Issue 239 https://doi.org/10.31174/SEND-PP2020-239VIII95-18

Анотація. *Розглянуто вплив фізичного навантаження на психоемоційний стан підлітків 11–14 років, які займаються в секціях з карате. Оцінку когнітивних здібностей підлітків вивчали за даними коректурної таблиці Ландольта. Аналіз впливу фізичного навантаження на когнітивні здібності осіб 11–14 років за даними коректурної проби показав підвищення рівня витривалості у обстежених майже вдвічі. Фізичне навантаження викликало збільшення відсоткового співвідношення підлітків з високим рівнем витривалості і, відповідно, зменшення з низьким.*

Ключові слова: *когнітивні здібності, фізичне навантаження, підлітки, розумова працездатність.*

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