



Features of forming coordination abilities and properties of the nervous system of schoolchildren (aged 11-12) at physical education classes

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Abstract

Introduction. *The problem of forming and improving modern adolescents' coordination abilities is relevant, considering the fact that most professional skills are based on these abilities. A number of studies indicate the relationship between the development of schoolchildren' coordination abilities and the properties of their nervous system. Thus, to date, these relationship has been quite poorly studied. The purpose of the article is to reveal the features of forming coordination abilities and properties of the nervous system of schoolchildren aged between 11 and 12 years in the process of physical education.*

Materials and Methods. *The methodological approach of this study is N. A. Bernstein's theory on the physiological basis of movement control. In order to assess the level of schoolchildren's motor coordination, the ability to kinetic differentiation, maintaining balance (Romberg's test), and the ability to coordinate movements were assessed. The properties of nervous system were studied using visual-motor reactions. The tests make it possible to determine a subject's reaction time to a visual stimulus, the stability of the reaction, the speed of decision-making in the choice reaction, and to assess the mobility of the main nervous processes in the central nervous system.*

Results. *The article presents the results of a study of forming coordination abilities and properties of schoolchildren's nervous system in the process of Physical Education classes. At the beginning of the experiment, schoolchildren, aged 11-12 years, had a below average level of the ability to balance and kinesthetic differentiation and a low level of development of the ability to coordinate movements. The time for a complex visual-motor reaction was significantly longer compared to a simple reaction. There were no significant differences in the indicators of visual-motor reactions of schoolchildren depending on their gender.*

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During Physical Education classes, when they do gymnastics, basketball and track and field athletics, some specially selected exercises were used aimed at developing coordination abilities in middle schoolchildren.

At the end of the experiment, schoolchildren aged 11-12 years were determined to have a high level of the ability to balance and kinesthetic differentiation and an above-average level of development of the ability to coordinate movements. According to the results of the experiment, the highest level of ability to kinesthetic differentiation and coordination of movements were shown by schoolchildren. The authors obtained data about the optimization of indicators of the nervous system properties, assessed by the magnitude of simple-motor reaction (SVMR) and complex visual-motor reaction (CVMR), which proves the leading role of the central nervous system in the formation of coordination abilities.

Conclusions. *The results of the work allow the authors to draw a conclusion about the relationship between the properties of the nervous system and the dynamics of coordination abilities, which determine the speed of the processes of excitation and inhibition, the mobility of nervous processes in the central nervous system, the ability to develop differential inhibition and the accuracy of the motor act in schoolchildren aged 11-12 years during the Physical Education classes.*

Keywords

Coordination abilities; Properties of the nervous system; Schoolchildren; Adolescents; Physical Education classes; Simple visual-motor reaction; Complex visual-motor reaction.

Introduction

Coordination abilities largely contribute to the formation of most professional skills. A number of aspects of schoolchildren's coordination abilities formation has not received a complete scientific rationale yet. As it is, we have discovered only a few research works on the topic. For instance, in the work by R. Hulteen [1] we find a detailed analysis of the existing "gaps" in the study of this problem. They are as following: there is no practice of measuring the development of coordination abilities throughout lifespan, the absence of large-scale studies on the topic; the lack of clear understanding of the skills "development", insufficient validity of the results obtained, etc. The author notes the need to create a comprehensive assessment system, promising for future scientific research, and suitable for

lifelong monitoring of the development and changes in people's coordination skills all over the world (R. M. Hulteen, et al., 2023 [1]). To date, the relationship between coordination abilities and the properties of adolescents' nervous system has been poorly studied as well. We found only a few publications on this problem. In 2016 A. Fort-Vanmeerhaeghe with co-authors presented a study of neuromuscular risk factors for sports injuries where one of the aspects of the study is the development of coordination abilities (A. Fort-Vanmeerhaeghe, et al., 2016 [2]). Also, in one of his works, Georgiy Polevoy uses a pedagogical experiment to explore the influence of the nervous system on the development of coordination abilities of schoolchildren (G. Polevoy, 2018)¹.

¹ Polevoy G. Development of the General Coordination Abilities of School Students Taking their Nervous System into Account. *International Journal of Medical Research & Health Sciences*, 2018, vol. 7 (11), pp. 166–

170. URL: <https://www.ijmrhs.com/medical-research/development-of-the-general-coordination-abilities-of-school-students-taking-their-nervous-system-into-account.pdf>

During Physical Education classes, when students do gymnastics, basketball and track and field athletics, some specially selected exercises were used aimed at developing coordination abilities in middle-aged schoolchildren. Most of researchers exploring the issues of motor coordination, stick to the opinion that basically they are developed much better in the process of doing some sport or fitness activities. They normally choose one or a few sports to research motor coordination (skills for it refer to: C. L. A. Costa, et al., 2021 [3]; M. Giuriato, et al., 2019 [4]). For instance, a study (“Differences in the Motor Coordination Abilities Among Adolescent Gymnasts, Swimmers, and Ice Hockey Players”) based on the material of different sports, was published in 2017 by Timo Jaakkola and his colleagues. Here with different results of assessing certain types of motor coordination (reverse crossbar passage, hopping over obstacles), the authors conclude that intensive sports training has a positive effect on the development of motor coordination, but only to the extent that is necessary in this particular sport (hockey, calisthenics and swimming were considered) (T. Jaakkola, et al., 2017 [5]). One more research, published in 2021, was carried out on the material of martial arts which require lots of postural balance (E. A. Cherepov, et al., 2021 [6; 7]).

In 2023 Italian scientists conducted a comprehensive study involving children who do swimming, gymnastics, cycling and track and field athletics. The purpose of the research was to test whether a certain sport affects the development of gross motor coordination. The scientists concluded that a sport has a significant impact on general motor coordination due to the different manner of performing movements in

each sport and the peculiar character of training process in it. As a result, trainers need to individually consider specific types of activities during trainings in order to maintain the integrity of children’s motor coordination development (V. Biino, et al., 2023 [8]).

Scientists agree that the development of motor-coordinating qualities, such as strength, speed, endurance, dexterity, accuracy and a number of others depend on many factors: “Gross motor coordination (GMC) development could be influenced by age, gender, weight status, geographical area, living settings, home environment, socio-economic status and sports practice” (V. Biino, et al., 2023 [8]). Thus, a group of researchers led by Carlos Luz presented the results of an interesting comparison of the motor skills in children of the same age (6-9 years and 10–13 years) in Portugal and the USA. Based on a series of tests, scientists came to the conclusion that cultural differences formed by the country of residence are a factor of influence in the development of motor skills (Luz, et al., 2019 [9]). Also M. C. Gallotta and a team in 2021 published a study on the influence of geographic territory and living conditions on motor coordination and physical activity (M. C. Gallotta, et al., 2021 [10]).

A number of studies examine the problem of improving schoolchildren’s motor-coordination qualities (V. I. Sivakov, et al., 2023 [11]; M. Kurnaz, et al., 2023 [12]). Features of the coordination abilities formation in children and adolescents with different health conditions, issues of its correction in the process of physical education are revealed in the works by I. V. Bogdanov, O. A. Dveyrina and others (I. V. Bogdanov, et al., 2023 [13]; O. A. Dveyrina², 2008). An interesting aspect of

² Dveyrina O. A. Coordination abilities: definition of the concept, classification of forms of manifestation. *Scientific Notes of P.F. Lesgaft University*, 2008, vol. 1 (35),

pp. 35–38. (In Russian) URL: <https://www.elibrary.ru/item.asp?id=10134234>

studying the problem is presented in the work by Giuseppe Battaglia “Interrelationship Between Age, Gender, and Weight Status on Motor Coordination in Italian Children and Early Adolescents Aged 6–13 Years Old”. The authors conclude that motor coordination decreases in children and adolescents (6–13 years old) who are overweight and obese (G. Battaglia, et al., 2021 [14]).

Coordination abilities are based on the anatomical and physiological characteristics of the body. Such hereditary characteristics include the basic properties of the nervous system, the degree and timing of maturation of various parts of the cerebral cortex, the state of sensory systems and the level of individual analyzers development, individual characteristics of the neuromuscular system and the features of basic mental processes. Despite the large number of publications on the topic of the research, there is no a unified approach to the problem of forming coordination abilities and their relationship with the nervous system properties.

The initial stage in the coordination abilities formation is in general school, where sufficient attention should be paid to their development. A number of studies confirm that schoolchildren who are actively involved in physical education and sports during school years are characterized by a higher level of development of coordination abilities compared to those who do not (N. Mischenko, et al., 2024 [15]). We find confirmation of this in the numerous works of Georgiy Polevoy – firstly, the researcher proves

that this particular age is ideal for the development of spatial coordination abilities and notes that schoolchildren who go in for sports have a better developed nervous system (about this refer to: G. Polevoy, 2017, 2018, 2019 [16; 17]³).

A number of aspects of schoolchildren’s coordination abilities formation have not yet received a full scientific solution. Thus, to date, the relationship between coordination abilities and the properties of the nervous system of adolescents has been poorly studied (G. Polevoy, 2018⁴; A. Fort-Vanmeerhaeghe, et al., 2016 [2]; F. Zereg, et al., 2017 [18]). There are data provided on the relationship between the level of coordination abilities development and the state of psychophysiological functions and properties of the nervous system (R. Boichuk, et al., 2019 [19]; L. I. Katashinskaya, et al., 2022 [20]; V. Milashechkin, et al., 2023 [21]; T. A. Fischer, et al., 2023 [22]). It is important to note here that there is a difference between the actual level of motor coordination development and the perceived level of its development (about it refer to: A. De Meester, et al., 2020 [23]).

The article examines the problem of developing and improving coordination abilities in modern adolescents and their relationship with the properties of the nervous system, which is relevant because these abilities underlie most professional skills.

The purpose of the study is to find out the features of forming coordination abilities and nervous system properties of schoolchildren, aged

³ Polevoy G. Development of the General Coordination Abilities of School Students Taking their Nervous System into Account. *International Journal of Medical Research & Health Sciences*, 2018, vol. 7 (11), pp. 166–170. URL: <https://www.ijmrhs.com/medical-research/development-of-the-general-coordination-abilities-of-school-students-taking-their-nervous-system-into-account.pdf>

⁴ Polevoy G. Development of the General Coordination Abilities of School Students Taking their Nervous System into Account. *International Journal of Medical Research & Health Sciences*, 2018, vol. 7 (11), pp. 166–170. URL: <https://www.ijmrhs.com/medical-research/development-of-the-general-coordination-abilities-of-school-students-taking-their-nervous-system-into-account.pdf>

11–12 years old in the process of Physical Education.

Methods

Experimental work was carried out on the basis of Secondary School No. 8 in the town of Ishim (Tyumen Region, Russia), from September 2023 to April 2024. The study was carried out with 40 people (20 boys and 20 girls) who are 6th Grade students aged 11–12 years. To assess the formation of coordination abilities and properties of the nervous system, the determination of the studied indicators was carried out at the beginning and end of the experiment. Testing coordination abilities included a number of techniques. Tests to assess the ability to kinesthetic differentiation included throwing a ball at a target while standing with your back to the target. A person stands behind the throwing line, with his back to the direction of the throw. He/she needs to throw the ball over his/her head or shoulder and hit a target located at a distance of 2 meters. An examinee was offered 1 trial and 5 test attempts. The test was scored as follows: a target hit to the mat – 1 point, to the gymnastic hoop – 2 points, between the hoop and the medicine ball – 3 points, in the medicine ball – 4 points.

Static balance was assessed using the Romberg's test to determine the ability to balance. A person takes the starting position: stands on one leg, the other is bent at the knee and turned outward as much as possible. The heel touches the popliteal cap of the supporting leg. The subject's hands are on the belt, the head is straight. On command, the subject closes eyes, and the time during which the subject maintains balance is noted.

Tests to determine the ability to coordinate movements were as following: a crouching position changed to a lying position. A participant takes the starting position: the main stance, then a crouching position, then change it to a lying position, again to a crouching position and then to

a starting position again. The result is assessed for 10 seconds; upon returning a test taker to the starting position, 1 point is counted.

The properties of the nervous system were studied using visual-motor reactions. To assess simple and complex visual-motor reactions, computerized methods of the “REFLEX” software set were used. To define a simple visual-motor reaction a participant's task was to press the selected key as quickly as possible whenever red squares appeared on the screen. To define a complex visual-motor reaction we used the test which allows to determine the time of a person's differentiation reaction to a visual stimulus, called the latent period of a complex visual-motor reaction; the stability of a complex visual-motor reaction; the speed of decision-making in a simple choice reaction and to assess the mobility of the main nervous processes in the central nervous system. A person's task was to press the selected key as quickly as possible when red squares appeared. When a different stimulus – a green square appears he/she should not press any keys. A person should not have any mistakes made. The results of the trials in milliseconds (ms) were compiled in a table, the stability of the reaction was determined. The number of false starts was taken into account, and the level of speed and stability of the reaction was determined.

The study was conducted after the voluntary informed consent was taken in accordance with the Protocol approved by the Ethics Committee of the Russian Academy of Sciences.

Statistical processing of the results was carried out using the Statistica 6.0 software package. The arithmetic mean, standard deviation, the error of the arithmetic mean were calculated, and the significance of the differences was determined using Student's t-criterion.

In our study, we planned an experiment to introduce special physical exercises aimed at developing coordination abilities and properties

of the nervous system into the Physical Education process in a group of 11–12 year old schoolchildren.

Results

To achieve this goal, at the initial stage of the study, the authors conducted ascertaining testing of the studied indicators with schoolchildren aged 11–12 years.

Results of the ascertaining stage of the study

To analyze the initial level of coordination abilities development and the properties of the nervous system in schoolchildren aged 11–12 years, we conducted the study using specialized tests. To do this, we conducted tests to assess the ability to kinetic differentiation (throwing a ball at a target while standing with your back to the target), tests examining balance abilities (Romberg's test), tests to determine the ability to coordinate movements (crouching

position – lying position). We studied the properties of the nervous system by the speed of simple and complex visual-motor reactions.

The results of the study of the above mentioned schoolchildren's coordination abilities and properties of the nervous system, which make it possible to determine the level of their initial development, are shown in Table 1.

As the analysis of Table 1 shows, at the initial stage of the experiment, girls had a below-average level of development of the ability to kinesthetic differentiation (the average results of throwing a ball at a target while standing with their back to the target were 4.19 points). Also, girls in Grade 6th had a below average level of development of the ability to balance (Romberg's test). According to the research literature, for the age of 12 years, the average time of stability of adolescents in the Romberg's position is 36 seconds; for the examined girls it was 23.5 seconds.

Table 1

Indicators of coordination abilities and properties of the nervous system of middle school children at the beginning of the experiment ($M \pm m$)

N o.	Groups of participants	Throwing a ball at a target while standing with your back to the target (points)	Romberg's test (seconds)	Crouched position–lying position (points for 10 seconds)	VMR speed (millisecond)	
					SVMR	CVMR
1	Girls	4.19 ± 0.32	23.5 \pm 1.06	2.20 \pm 0.13	240.39 \pm 4.29	375.79 \pm 3.40
2	Boys	4.80 ± 0.53	23.70 \pm 0.80	2.40 \pm 0.16	264.39 \pm 6.20	366.39 \pm 4.55

Note: the reliability of differences between the indicators for girls and boys: * - $P \leq 0.05$.

Based on the results of studying the ability to coordinate movements (crouching position – lying position test), a low level of development was determined in girls at the initial stage of the experiment. The average score in this test was 2.20 points.

The state of the properties of the nervous system and reactions to various stimuli were

assessed based on the time of simple and complex visual-motor reactions (SVMR and CVMR). At the initial stage of the experiment, the average VMR speed in girls was 240.39 ms. The time for a complex visual-motor reaction was significantly longer in girls compared to the duration of a simple visual-motor reaction. At the ascertaining stage of the experiment, girls had a below-average

level of development of the ability to balance and kinesthetic differentiation and a low level of the ability to coordinate movements.

At the initial stage of the experiment (Table 1), boys had a below-average level of development of the ability to kinesthetic differentiation (the average result of throwing a ball at a target while standing with their back to the target was 4.80 points). Like their female peers, boys had a below-average level of development of the ability to balance (Romberg's test). The result of the Romberg's test was 23.7 s for boys. According to the results of the crouching position – lying position test, boys at the initial stage of the experimental work were determined, just like their female peers, to have a low level of development of the ability to coordinate movements. The average score in this test for boys was 2.40 points. The initial average speed of SVMR in boys was 264.39 ms, of the complex one – 366.39 ms, respectively.

At the beginning of the experimental work, the boys had a below average level of development of the ability to balance and kinesthetic differentiation and a low level of development of the ability to coordinate movements. There were no statistically significant differences in the indicators of visual-motor reactions of schoolchildren depending on the gender.

The data obtained allow us to state that there are reserves for increasing the level of development of coordination abilities in schoolchildren aged 11–12 years at Physical Education lessons.

Methodology for organizing classes aimed at developing coordination abilities and nervous system properties in schoolchildren aged 11–12 years during Physical Education lessons

Based on the results obtained at the ascertaining stage of the experiment, we compiled

and experimentally tested the effectiveness of a program aimed at increasing the level of development of coordination abilities and improving the properties of the nervous system in schoolchildren aged 11–12 years at Physical Education classes. The developed program used specially selected exercises aimed at developing coordination abilities in middle-aged schoolchildren to be implemented when children do gymnastics, basketball and athletics.

The exercises used in the “Gymnastics” section contributed to the development of such coordination abilities as the ability to control the body in space, maintain balance and perform precise movements. The exercises from the “Basketball” section were aimed at developing coordination abilities when performing motor reactions to various stimuli. The implementation of exercises in the “Athletics” section is aimed at increasing coordination abilities due to improving the functioning of the neuromuscular system.

Based on the results of the testing, the effectiveness of the experiment was determined.

After implementing the developed program at Physical Education lessons, the level of development of coordination abilities and properties of the nervous system of schoolchildren was re-tested.

Results of the forming stage of the study

To analyze the effectiveness of the experiment results, the dynamics of indicators of coordination abilities and properties of the nervous system in schoolchildren aged 11–12 years was assessed at the ascertaining and control stages of the experiment.

The average indicators of coordination abilities in schoolchildren aged 11–12 years before and after the experiment are presented in Tables 2 and 3 and Figure 1.

Table 2

Dynamics of coordination abilities and properties of the nervous system of middle school children (girls) (M± m)

Indicators	Throwing a ball at a target while standing with your back to the target (points)	Romberg`s test (seconds)	Crouched position–lying position (points for 10 seconds)	VMR speed (millisecond)	
				SVMR	CVMR
Before the experiment	4.19 ± 0.32	23.5±1.06	2.20±0.13	240.39±4.29	375.79±3.40
After the experiment	7.69 ± 0.30	32.79±0.74	4.09±0.23	209.30±2.81	330.79±5.23
t	7.95	7.20	7.26	6.07	7.21
p	p ≤0.05	p ≤0.05	p ≤0.05	p ≤0,05	p ≤0,05

Comparing the indicators of the level of coordination abilities and properties of the nervous system of boys and girls at the beginning and end of the experiment (Table 2 and Table 3), we can state that there was a statistically significant development of coordination abilities and a decrease in the latent period of simple and complex visual-motor reactions, which indicates optimization of nervous system and neuromuscular system properties. At the beginning of the experiment, in the test “throwing a ball at a target, standing with your back to the

target”, the level of development of the ability for kinesthetic differentiation corresponded to a below average level, and at the end of the experimental work, it raised to a high level of development. The value of Student's t-test allows us to note that these differences are statistically significant. The increase in the level of development of the ability to balance, assessed by the Romberg’s test was statistically significant for boys and girls. For boys, at the beginning of the experiment the average results of the Romberg’s test was 23.7 s, and at the end – 34.2 s.

Table 3

Dynamics of indicators of coordination abilities and properties of the nervous system of middle school children (boys) (M± m)

Indicators	Throwing a ball at a target while standing with your back to the target (points)	Romberg`s test (seconds)	Crouched position – lying position (points for 10 seconds)	VMR speed (milliseconds)	
				SVMR	CVMR
Before the experiment	4.80 ± 0.53	23.70±0.80	2.40±0.16	264.39±6.20	366.39±4.55
After the experiment	8.30 ± 0.53	34.20±0.86	4.69±0.15	221.0±4.35	324.5±4.44
t	4.73	8.97	9.95	5.73	6.62
p	p ≤0.05	p ≤0.05	p ≤0.05	p ≤0.05	p ≤0.05

Grade 6th students developed the ability to coordinate movements. At the initial stage of the experiment, girls' average scores in the crouching-lying position test were 2.20 points, and at the end they showed statistically significant increase of 4.09 points. A similar picture is observed in the boys' dynamics of the ability to coordinate movements. The value of Student's t-test is 9.95, which indicates the statistical significance of the differences obtained.

The implementation of the original program for the formation of coordination abilities by middle school students contributed to the optimization of the properties of the nervous system, assessed by the time of simple and complex visual-motor reactions.

The obtained results of the time of SVMR and CVMR at the beginning and the end of the experiment allow us to state a reduction in the time of motor reaction to stimuli, which will determine an increase in the level of development of coordination abilities and functional capabilities of the neuromuscular system. The results obtained correspond to data, indicating a decrease in the speed of simple and complex visual-motor reactions with age, which is a marker of the development and improvement of the central nervous system.

Figure 1 shows indicators of coordination abilities and properties of the nervous system in middle school students at the beginning and at the formative stage of the study.

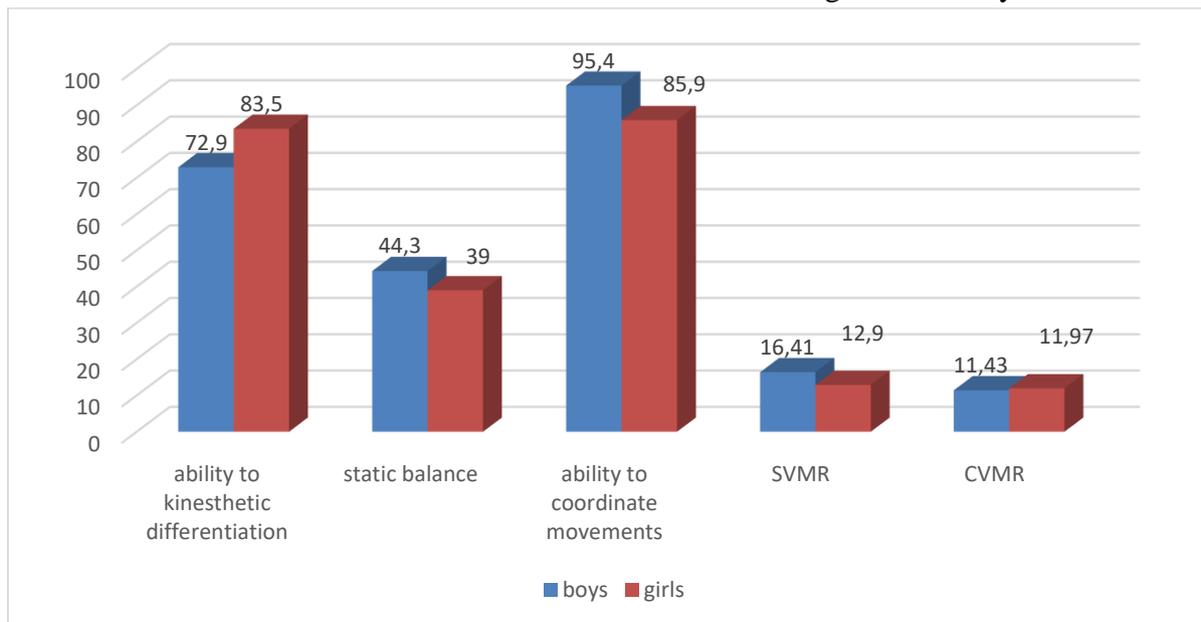


Figure 1. Dynamics of indicators of coordination abilities and properties of the nervous system in middle school students (%)

Discussion

The greatest percentage of growth in boys and girls during the implementation of the original program was noted in the ability for kinesthetic differentiation and coordination of movements. There was an optimization of indicators of the properties of the nervous system,

assessed by the value of SVMR and CVMR (Figure 1). In boys, the percentage decrease in the rate of SVMR was 16.41, in girls – 12.9 %. In our opinion, this is due to the fact that at the age of 12 years there is an intensive development of the nerve centers of the brain responsible for complex motor reactions.

The established gender differences in the rate of increase in coordination abilities are due to the different rates of onset of puberty in boys and girls.

At the beginning of the experiment, schoolchildren aged 11–12 years old had a below average level of the ability to balance and kinesthetic differentiation and a low level of the ability to coordinate movements. There were no statistically significant differences in the indicators of visual-motor reactions of schoolchildren depending on gender.

At the end of the experiment, schoolchildren aged 11–12 years old had a high level of the ability to balance and kinesthetic differentiation and an above-average level of the ability to coordinate movements. The greatest increase in results among schoolchildren during the implementation of the developed program was noted in the ability to kinesthetic differentiation and coordination of movements.

The indicators of the nervous system properties, assessed by the magnitude of simple and complex visual-motor reactions were

optimized. In boys, the percentage of decrease in the speed of a simple visual-motor reaction was 16.41, in girls – 12.9 %, in a complex visual-motor reaction – about 12 %.

Conclusions

Based on the study, the authors came to the conclusion that the age of 11–12 years is sensitive to the formation of coordination abilities. At this age stage, the development of sensorimotor and neural mechanisms underlying coordination abilities occurs. Therefore, with optimal organization of Physical Education classes, the best developmental effect will be ensured.

The results of the study showed that the greatest increase in schoolchildren aged 11–12 years was noted in the ability for kinesthetic differentiation and coordination of movements and the nervous system properties, which determine the speed of the processes of excitation and inhibition, the mobility of nervous processes in the central nervous system, the ability to quickly develop differential inhibition and the accuracy of the motor act performed.

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Научная статья / **Research Full Article**
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Особенности формирования координационных способностей и свойств нервной системы школьников 11–12 лет в процессе занятий физической культурой

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Проблема и цель. Проблема формирования и совершенствования координационных способностей у современных подростков является актуальной, поскольку эти способности лежат в основе большинства профессиональных навыков. В ряде исследований указывается на взаимосвязь формирования координационных способностей и свойств нервной системы школьников. Так, до настоящего времени слабо изучена взаимосвязь координационных способностей и свойств нервной системы подростков. Цель статьи заключается в выявлении особенностей формирования координационных способностей и свойств нервной системы школьников 11–12 лет в процессе занятий физической культурой.

Методология. Методологическим подходом проведенного исследования выступает учение Н. А. Бернштейна о физиологических основах управления движениями. Для оценки уровня развития двигательной координации школьников оценивалась способность к кинетическому дифференцированию, поддержанию равновесия (проба Ромберга), способность к согласованию движений. Исследование свойств нервной системы проводилось с помощью зрительно-моторных реакций. Тесты позволяют определить время реакции испытуемого на зрительный раздражитель, стабильность реакции, скорость принятия решения в реакции выбора, оценить подвижность основных нервных процессов в центральной нервной системе.

Результаты. В статье представлены результаты исследования формирования координационных способностей и свойств нервной системы школьников в процессе занятий физической культурой. В начале эксперимента у школьников 11–12 лет определен ниже среднего уровень развития способности к равновесию и кинестетическому дифференцированию и низкий уровень развития способности к согласованию движений. Время сложной зрительно-моторной реакции, по сравнению с простой реакцией, было значительно больше. Значимых различий в показателях зрительно-моторных реакций школьников в зависимости от пола выявлено не было.

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В процессе занятий физической культурой были использованы специально подобранные упражнения, направленные на развитие координационных способностей у школьников среднего возраста, реализуемые в разделах «Гимнастика», «Баскетбол» и «Легкая атлетика».

В конце эксперимента у школьников 11–12 лет авторами был определен высокий уровень развития способности к равновесию и кинестетическому дифференцированию и выше среднего уровень развития способности к согласованию движений. По результатам проведенного эксперимента наибольший уровень развития у школьников отмечался по способности к кинестетическому дифференцированию и согласованию движений. Авторами получены данные, указывающие на оптимизацию показателей свойств нервной системы, оцениваемой по величине простой и сложной зрительно-моторных реакций, что доказывает ведущую роль центральной нервной системы в формировании координационных способностей.

Заключение. *Результаты работы позволяют сделать заключение о взаимосвязи свойств нервной системы с динамикой координационных способностей, определяющих скорость протекания процессов возбуждения и торможения, подвижность нервных процессов в центральной нервной системе, способность к быстрой выработке дифференцировочного торможения и точности выполняемого двигательного акта у школьников 11–12 лет, в процессе занятий физической культурой.*

Ключевые слова: *координационные способности; свойства нервной системы; школьники; подростки; занятия физической культурой; простая зрительно-моторная реакция; сложная зрительно-моторная реакция.*

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