



DEVELOPMENT OF SPEED AND STRENGTH ABILITIES OF CHILDREN, TAKING INTO ACCOUNT THE TYPOLOGY

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ABSTRACT

The purpose of the study is to test and implement a set of physical exercises for developing the strength and speed abilities of students, as well as to test the effectiveness of the differentiated method in physical education lessons, taking into account the type of nervous system in the learning process. All students must perform 3 control tests: a long jump from a standing position (cm), lifting the trunk from a lying position (20 seconds), flexion, and extension of the arms while lying on the floor (20 seconds). The students were given the task to pass a tapping test. The indicators of the control group did not significantly improve from 4% to 6% after the end of the pedagogical experiment. In the experimental group - 1, the indicators improved from 9% to 14% during the experiment period. In the experimental group - 2, the indicators significantly improved in children with a strong nervous system from 12% to 16% and schoolchildren with a weak nervous system from 13% to 19%. If you perform a set of physical exercises for the development of strength and speed abilities in physical education classes, then the indicators of such abilities will improve. If you perform a set of exercises with a differentiated load, taking into account the strength of the nervous system, then the indicators of speed and strength abilities will significantly improve.

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Introduction

Currently, children's health is of great importance in society all over the world. Of course, a great contribution to the growth and development of the child's body is made by the physical culture at school [1, 2]. In preschool and primary school age, a significant part of physical culture in school is made up of outdoor games, which are focused on the development of motor abilities of schoolchildren [3-5]. At the same time, middle school schoolchildren, schoolchildren 13-14 years old can perform more high-speed and power movements. This is also evidenced by studies devoted to sensitive periods of the development of physical qualities. So, for example, in seventh-graders, whose age is 13-14 years, it is necessary to purposefully develop speed-power abilities. This period is favorable for the development of these physical qualities [6, 7].

It should be noted that speed-strength abilities are characterized by unsaturated muscle tension, manifested with maximum power in exercises that are performed at a significant speed but do not reach the maximum value.

Speed-power abilities are manifested in motor actions, in which, along with significant muscle strength, speed of movement is also required (for example, repulsion in long and high jumps from a place and from a run-up, the final effort when throwing sports equipment) [8].

The value of speed and strength abilities for a schoolchild is very important. Especially if the child is engaged in any kind of sport. High-quality development of speed-power abilities at this age gives the mind great advantages. At the same time, if the schoolchildren do not play sports in addition, it is extremely necessary to develop these qualities in the middle school age, since it is at this age that they lend themselves to purposeful training [9-11].

A differentiated approach is of great importance in working with children of different ages and genders. The application in practice of the methods of organizing a differentiated approach in physical education classes allows you to achieve an increase in the indicators of physical development and physical fitness, improve the functional state of the body, strengthen the health of schoolchildren, and effectively prepare for passing standards and tests in physical culture [12-14].

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It should be noted the variety of criteria by which children in physical education lessons are differentiated into groups, such as gender, age, level of physical development, and some other objective and subjective indicators. In our opinion, it is promising to study the typological features of the manifestation of the properties of the nervous system. Among the features of the nervous system, it is distinguished by its strength, mobility of nervous processes, and lability. However, some studies have proved the effectiveness of using the power of nervous processes as a criterion for differentiating schoolchildren into groups in physical education classes at school [8, 15, 16].

Thus, the purpose of the study is the additional introduction of a set of physical exercises in addition to the work program on physical culture at school, which develop the speed and strength abilities of students aged 13-14 years and to test the effectiveness of a differentiated approach in physical education lessons, taking into account the typological criterion of strength-weakness of the nervous system with the peculiarities of the excitation process.

Materials and Methods

Participants

In the ordinary secondary school No. 60 Kirov, about 22-26 people study in every seventh grade. However, not all of them are healthy and are allowed to take regular physical education classes. The study involved schoolchildren from class 7a (18 people), class 7b (18 people), and class c (18 people). Thus, 54 schoolchildren (boys and girls aged 13-14) who were healthy for health reasons, had the main medical group, and were admitted to physical education lessons took part in the pedagogical experiment.

Procedure

The special experiment lasted for 4 months from September 9 to December 20, 2019. Physical education classes at the school were held in the gym 2 times a week for 40 min each lesson. A total of 30 lessons were conducted in each class.

The choice of such a training segment for research is not accidental. Since at the beginning of the year the children are sufficiently mobilized and set up for the learning process, it was necessary to start the experiment from the beginning of the school year. The study lasted until the beginning of the new calendar year, namely, until the beginning of the holidays with a long interval of rest. For the studied indicators to be as informative as possible, it was necessary to avoid large pauses in the educational process in physical culture.

Before the beginning of the pedagogical experiment, 3 groups were formed using a simple random sample [17].

1. The control group (CG) – schoolchildren from class 7a who were engaged in the stand. program in physical culture and did not perform any additional tasks [18].
2. Experimental group 1 (EG-1) – schoolchildren from class 7b, who were engaged in a stand. program of physical culture and in addition, 7-9 minutes after the warm-up and flexibility exercises, speed and strength exercises were applied. The exercises for each lesson were selected in such a way that the complex included the development of the maximum number of muscle groups, including the muscles of the arms, abdomen, legs, and others.

The complex of physical exercises for developing strength and speed abilities includes the following exercises for different muscle groups:

1. pull-up on the crossbar with a different grip with a weight;
2. throwing from behind the head of a stuffed ball at a distance from a prone position;
3. working with dumbbells on the upper shoulder belt;
4. "push-ups" from the floor;
5. exercises performed with additional weights (belt, vest, cuff, weighted projectile);
6. fast running in a straight line, fast movement sideways, back, moving with a change of direction;
7. different jumps on two legs, from foot to foot, on one leg, in-depth, in height, in range;
8. exercises related to bends, turns of the trunk, performed at maximum speed.

In working with the class, the method of standard-repeated execution of the exercise was used.

3. Experimental group 2 (EG-2) – schoolchildren from class 7c, who engaged in a standard program and additionally performed a set of exercises for the development of strength and speed abilities, which were performed by children from class 7b. However, in contrast to EG-1, the load components in this group were different for schoolchildren with different nervous system strengths (**Table 1**).

Table 1. The load on physical education lessons for children, taking into account the strength of their nervous system

Load components	Children with a strong nervous system	Children with weak nervous systems
Duration of one exercise	1-2 min	2-3 min
Rest time	Full recovery	
Type of vacation	Passive	
Number of repetitions per series	Up to the maximum	

Number of series of one exercise	2-3 series	4-5 series
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Table 1 shows that students with a weak nervous system performed each exercise longer than children that have a strong nervous system. The number of repetitions of one exercise in a subgroup of children with a weak nervous system was also higher. That is, in 10 minutes at each lesson, children with a strong nervous system managed to perform 6-7 exercises, and children with a weak nervous system - 4-5 exercises. This is due to the typological feature of students with different nervous systems. Children with a strong nervous system can switch more actively from one exercise to another, and children with a weak nervous system need more time to train [8, 15, 16].

Before the beginning and after the end of the pedagogical experiment, all children performed a control test:

1. Speed and power abilities were evaluated according to 3 indicators:

1.1. Long jump (cm)

Procedure: The legs are shoulder-width apart, the feet are parallel, the toes are placed in front of the line. Simultaneous push with both feet, the student leaps forward. You can wave your hands. The result is up to the nearest trace after the jump left by any part of the participant's body.

The participant is given two attempts. The best result is counted [19].

1.2. Lifting the torso (20 sec)

Procedure: Lie on the gym mat, hands behind the head fastened together, shoulder blades touching the mat, legs should be bent at the knees, feet pressed to the floor.

The student performs a large amount of lifting of the trunk in 20 seconds, touches his hips with his elbows, and then returns to the starting position. The maximum number of correctly performed lifts of the student is calculated.

Alternately, one of the partners performs the exercise, the other holds his legs by the feet and (or) shins [20].

1.3. Flexion and subsequent extension of the arms (20 sec)

Procedure: the emphasis is lying on the floor, the arms are placed shoulder-width apart and forward, the elbows are spread apart.

The maximum number of cycles consists of flexion and subsequent extension of the arms using an electronic platform.

Bending your arms, you need to touch the chest of the contact platform with a height of 5 cm, then, unbending your arms, return to the starting position [21].

2. Tapping test evaluates the strength of the nervous system by the process of arousal.

On a regular sheet of A4 paper, 6 identical squares are shown (3 squares at the top and 3 squares at the bottom) (**Table 2**).

Table 2. The form for conducting the tapping test

1	2	3
6	5	4

Schoolchildren sit at a desk with a pencil in their hands. At a signal from the teacher, all children begin to put dots in the first square with a pencil at maximum speed. After 5 seconds, at the command of the teacher, they move to the 2nd square and so on, up to the 6th square. At the end of the test, the number of points is counted. If their number begins to decline sharply from the first to the last square, then such children belong to the type of strong nervous system. If the number of dots remains the same or increases at the end, then children belong to a subgroup with a weak nervous system [8].

Excel was used in the course of statistical results. The average value and average deviation in each test, % of the effectiveness of exercises for the development of the studied abilities in all groups and subgroups, taking into account the typology, are determined.

Results and Discussion

All 54 schoolchildren took control tests. The indicators are presented in **Table 3** and **Table 4**.

Table 3. Indicators of schoolchildren aged 13-14 years in CG and EG-1

Test	Control group			Experimental group – 1		
	Before	After	%	Before	After	%
Long jump from (cm)	169,7±18	179,8±19,1	+6%	172,6±21,5	196,7±24,5	+14%
Lifting the torso (20 sec)	13,1±2,3	13,3±2,3	+4%	12,8±2,4	13,9±2,7	+9%
Flexion and extension of the arms (20 sec)	7,1±1,8	7,5±1,9	+6%	7,6±1,7	8,4±1,9	+10%

Table 3 shows that after the end of the pedagogical experiment, there were positive changes in all the indicators of both groups. However, if the schoolchildren from the control group managed to improve their performance in the test "Long jump" by only 6%, then the performance in EG-1 improved by 14%.

In the "Lifting the torso" test, the performance of the control group improved by 4%, and the performance in EG-1 improved by 9%.

In the test "flexion and extension of the arms at the stop while lying on the floor", the indicators in CG improved by 6%, and the indicators in EG-1 improved by 10%.

Such results may indicate that the natural increase in speed and strength abilities at the age of 13-14 years and the effectiveness of the standard physical education program at school are beyond doubt. However, the situation in EG-1 turned out to be more effective due to the introduction of a set of exercises for developing strength and speed abilities, since the increase in indicators in all tests in EG-1 schoolchildren is higher than in children from CG.

It should be noted that before the start of the study, the results of the tapping test identified 10 schoolchildren in the subgroup with a strong nervous system and 8 schoolchildren in the subgroup with a weak nervous system. The indicators for all tests before and after the experiment are presented in **Table 4**.

Table 4. Indicators of strength and speed abilities of schoolchildren aged 13-14 years in EG-2

Test	Strong nervous system			Weak nervous system		
	Before	After	%	Before	After	%
Long jump (cm)	175,2±14,9	203,3±17,3	+16%	172,7±17,5	205,5±20,9	+19%
Lifting the torso (20 sec)	11,5±2,3	12,9±2,6	+12%	12,1±2,5	13,7±2,8	+13%
Flexion and extension of the arms (20 sec)	7,7±1,7	8,6±1,9	+12%	7,8±1,2	8,9±1,3	+14%

Table 4 shows that the indicators of schoolchildren with both strong and weak nervous systems increased significantly more than the indicators of CG and EG-1.

For example, in EG-2, schoolchildren that have a strong nervous system increased their performance in the test «Long jump from a place with a push with two legs» by 16%, and in children with a weak nervous system by 19%.

In the «Lifting the torso from the supine position» test, schoolchildren with a strong nervous system had a 12% increase in performance, while children with a weak nervous system had a 13% improvement in performance.

In the "Flexion and subsequent extension of the arms" test, the performance of students with a strong nervous system improved by 12%, and in children with a weak one – by 14%.

Thus, we can confidently speak about the effectiveness of using the typological criterion as a method of differentiating schoolchildren into subgroups, taking into account the strength of the nervous system in the process of arousal

The results of the study, which were obtained in the CG, reveal that the indicators of speed and strength abilities increase in the course of educational activities without special impact on them. This suggests that the age of 13-14 years is a favorable period for the development of speed-power abilities. This is confirmed by previous studies [6, 7]. It is also worth noting the positive impact on the development of speed and strength abilities of the standard program on physical culture in school [18]. In comparison with the schoolchildren from the CG, the children from EG-1 significantly improved their performance on all three tests. Thus, if you perform a complex set of physical exercises after warming up for 10 minutes at each physical culture lesson at school, the speed and strength abilities' indicators will grow faster than if schoolchildren are engaged in the usual program.

The results of the study in EG-2, speak about the effectiveness of employing a different method in physical education lessons at school, many studies confirm this [12-14]. It is necessary to emphasize the effectiveness of the introduction of different components of the load for children aged 13-14 years. Children with a strong nervous system are characterized by an intense load, that is, a frequent change of physical exercises and a reduction in the number of series when performing one exercise. At the same time, schoolchildren with a weak nervous system are characterized by a more voluminous load, namely, less exercise and more repetitions. These results are confirmed by previous studies [8, 15, 16].

In this study, for the first time, different components of physical activity were introduced into the school process for physical education for schoolchildren aged 13-14 years with different nervous system strengths. The effectiveness of special exercises has been proven by the results of a new study.

Thus, the goal of the study was achieved after the implementation of the pedagogical experiment.

Conclusion

If perform a set of physical exercises for 10 minutes during physical education lessons at school after warming up and stretching the muscles, which is aimed at the development of strength and abilities speed, then our indicators of such abilities in schoolchildren will significantly improve. If you perform this complex, taking into account the different loads for children with weak a and strong nervous system, then the indicators of speed and strength abilities will become even higher.

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