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# The influence of speed and strength training at school on the indicators of attention switching in children aged 13–14 years with different typologies

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## Abstract:

**BACKGROUND:** The background is to determine the influence of speed and strength training of schoolchildren aged 13–14 on the indicators of the ability of children with different nervous system strength to switch attention.

**MATERIALS AND METHODS:** This was a cross-sectional study conducted on sixty schoolchildren in a class 7, located in the city of Kirov, in Russia. The data were collected using an independent pedagogical experiment. Physical education at the school was held two times a week for 40 min each lesson. Children from class 7a (20 people) were engaged in the usual program and formed a control group. Children from class 7b (20 people) formed an experimental group, they performed an additional set of physical exercises at each lesson, aimed at developing speed and strength abilities. The strength of the nervous system was determined by tapping test, and the indicators of switching the attention of schoolchildren were determined by the test «Method of Numbers». T-student was used.

**RESULTS:** After the pedagogical experiment, the indicators of attention switching in the control group improved. In children with a strong nervous system, the indicator was higher by 7%, and in children with a weak nervous system, the indicators increased from  $33.7 \pm 3.1$  s to  $32.0 \pm 2.9$  s. At the same time, in the experimental group, in both subgroups, the indicators increased significantly. Children with a strong nervous system improved performance by 14%, and children with a weak nervous system improved performance from  $34.4 \pm 3.9$  s to  $29.2 \pm 3.3$  s.

**CONCLUSION:** The indicators of switching the attention of children aged 13–14 years will improve if they perform physical exercises at each physical culture lesson at school, which are aimed at developing speed and strength abilities. The components of the load for the development of abilities should be differentiated taking into account the strength of the schoolchildren nervous system.

## Keywords:

Attention switching, physical education, schoolchildren, speed abilities, strength abilities

## Introduction

The health of preschool and school-age children is of leading importance worldwide.<sup>[1-3]</sup> The leading role in the growth and development of the child is provided by the school, namely, physical education classes. At each lesson, schoolchildren receive not only knowledge but also motor skills that accompany them through life.<sup>[4-6]</sup>

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As a rule, children in the lower grades (Grades 1–3) often work on the development of flexibility, motor performance, and coordination of movement. Here, outdoor games and noncomplex elements of sports games come to the fore. Classes acquire a bright and emotional color. Older schoolchildren (middle level) are more focused on the development of such qualities as strength, speed, endurance, and others. The sensitive period for the

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development of speed-power abilities is the age of 13–14 years.<sup>[7-9]</sup>

The effectiveness of the use of a set of exercises aimed at the development of speed and strength abilities was proved in a previous study.<sup>[10]</sup> The use of such a complex in physical education classes at school gives an effective result in terms of active development of children, it is an excellent addition to the standard physical education program at school.<sup>[11]</sup>

In physical education classes, it is recommended to use a differentiated approach more often when working with children of both junior and middle management.<sup>[12-14]</sup> One of the most effective criteria for differentiating children into subgroups is the typological criterion (the strength of the nervous system in the process of arousal).<sup>[10]</sup>

In this study, it was important for us to find out whether a set of speed-strength exercises has an effect on the indicators of switching the attention of schoolchildren who have different typologies (different strength-weakness of the nervous system in the process of arousal).

At the same time, there is certainly enough experience of works that speak about the relationship between physical activity and mental processes of children and adults.<sup>[15-17]</sup>

The aim of the study is to determine the influence of speed and strength training of schoolchildren aged 13–14 on the indicators of the ability of children with different nervous system strength to switch attention.

For the first time, had to find out the influence of speed-power abilities on the indicators of attention switching of schoolchildren aged 13–14.

## Materials and Methods

### Study design and setting

This was a cross-sectional study conducted on sixty schoolchildren in a class 7, located in the city of Kirov, in Russia. The data were collected using an independent pedagogical experiment.

### Study participants and sampling

In total, forty schoolchildren took part in the study, which were divided into classes into groups.

7a class (20 children, 12 boys and 8 girls) and control group (CG).

7b class (20 children, 12 boys and 8 girls) – experimental group (EG).

For the period of the pedagogical experiment, all children were healthy and admitted to physical education lessons,

they had a reference for health reasons related to the primary and preparatory medical group.

### Data collection tool and technique

The statistical analysis was carried out using the Microsoft Excel program. The average indicators of switching the attention of schoolchildren, the standard deviation from the average value, are determined. The percentage of growth of indicators in each subgroup is determined. T-student was used.

### Ethical consideration

All procedures met the ethical standards of the 1964 Declaration of Helsinki. Informed consent was obtained from all parents of the children included in the study.

The pedagogical experiment began on January 12, 2020 and ended on March 20, 2020. All physical education classes at the school were held for 3 months twice a week for 40 min each lesson. The schedule of physical education classes at the school did not change during the study period. Children from class 7a were engaged on Tuesdays (8:50–9:30) and Fridays (9:40–10:20), and children from class 7b were also engaged on Tuesdays (9:40–10:20) and Fridays (8:50–9:30).

Schoolchildren from CG (7a) were engaged in the standard physical education program for ordinary schools. And additionally did not perform any exercises.<sup>[11]</sup>

Schoolchildren from EG (7b) were engaged in the same program, but at each lesson, they additionally performed exercises to develop their speed and strength abilities. The components of the load in children with different nervous systems were different. Schoolchildren with a strong nervous system performed more exercises, but fewer series (that is, the load was more intense). Schoolchildren with a weak nervous system are not able to quickly switch from one exercise to another, since the process of working out in such children is usually longer. All the exercises that made up the prepared complexes were not difficult. These are exercises such as running, jumping, squats, push-ups, pull-ups, working with dumbbells, and many others.<sup>[10]</sup>

Before the experiment, all schoolchildren took the Tapping test (the strength of the nervous system) and the «Method of Numbers» (the ability to switch attention).

### Tapping test

At the command of the teacher on a sheet of A4 paper, children very quickly put dots with a pencil in a certain square. They move sequentially from 1 to 6 squares every 5 s. Then, a schedule was formed, the strength

of the nervous system was determined by the process of arousal, and the load for physical exercises was selected.<sup>[10]</sup>

### Method of numbers

Two large squares are shown on A4 paper. Each of them has 16 squares with numbers from 1 to 16 [Table 1].<sup>[18]</sup>

### Procedure

At the signal of the teacher, the children should switch their attention, first cross out the number 1 in one square, then in the other. After that, you need to cross out the number 2 in both squares. And so on until 16. The result is the time spent on the test(s).

## Results

Before the start of the study, all schoolchildren took a tapping test, according to the results of this test, schoolchildren from class 7b were differentiated into two subgroups: Ten children with a strong nervous system and 10 with a weak one. In class 7b, the distribution was similar. Table 2 shows the results of the test for the ability to switch attention in schoolchildren aged 13–14 years at the beginning and at the end of the pedagogical experiment.

Table 2 shows that, within 3 months, the indicators of switching the attention of schoolchildren improved in all subgroups, however, objectively, the indicators in both subgroups in EG are higher than in CG.

Schoolchildren from the CG who were engaged in physical education according to the usual program in the subgroup with a strong nervous system improved the average performance of  $36.7 \pm 2.8$  s to  $34.1 \pm 2.6$  s, and in the subgroup with a weak nervous system by 6%. A fairly small increase in the indicators of attention switching of schoolchildren aged 13–14 years indicates a positive impact of the standard physical education program at school and a natural increase in the indicators of mental processes in this age period.

**Table 1: Example of a blank in the «method of numbers test**

5	12	7	2	10	3	13	8
15	1	10	13	2	9	5	15
9	14	8	4	14	7	12	1
6	3	16	11	11	4	16	6

**Table 2: Indicators of the ability to switch attention in children aged 13-14 years**

Groups	Nervous system	Before	After	Percentage	P
Control	Strong	36.7±2.8	34.1±2.6	+7	>0.05
	Weak	33.7±3.1	32.0±2.9	+5	>0.05
Experimental	Strong	33.7±3.5	28.3±3.0	+14	<0.05
	Weak	34.4±3.9	29.2±3.3	+15	<0.05

Schoolchildren from the EG additionally performed a set of exercises aimed at developing speed and strength abilities, taking into account the strength of the nervous system in the process of arousal. During the study period, in the subgroup of children with a strong nervous system, the indicators improved by 14%, in children with a weak nervous system, the indicators improved from  $34.4 \pm 3.9$  s to  $29.2 \pm 3.3$  s. Such results may indicate the effectiveness of the use of speed-strength exercises in physical education classes at school, taking into account the strength of the schoolchildren nervous system.

## Discussion

The importance of physical education classes in school is very great, children learn not only mental knowledge but also develop physically.<sup>[4-6]</sup>

The results obtained after the end of the pedagogical experiment confirm the authors opinion that there is a relationship between the physical activity of schoolchildren and their mental processes.<sup>[15-17,19,20]</sup>

The effectiveness of the modern standard physical education program for schoolchildren of grades 1–11 was proved in the course of the study. The foundations laid down in the program in a positive way affect the ability of schoolchildren to switch their attention. This is evidenced by the results obtained in the control group.

It is necessary to emphasize the importance of a differentiated approach in working with young and middle-aged children. This approach is able to more effectively mobilize the body systems of each schoolchildren and fully unlock the potential of their physical abilities. However, there are a sufficient number of criteria by which children are differentiated into subgroups, taking into account some feature.<sup>[12-14]</sup>

One of the more effective and proven methods of differentiating children into subgroups is the typological criterion (that is, the strength of the schoolchildren nervous system).<sup>[10]</sup> The results of the study emphasize the effectiveness of using a differentiated approach based on typology, since children from the experimental group outperformed schoolchildren from the control group in both subgroups in terms of attention switching.

The results obtained in the experimental group require a separate explanation. The children in this group performed an additional set of exercises at each physical education lesson, which is aimed at developing speed and strength abilities. The load was differentiated depending on the strength of the schoolchildren nervous system. At the end of the study, it is clear that a set of exercises taking into account the typology gave a

high effect on the development of the ability to switch attention in children in both subgroups.

Thus, for the first time, a study was conducted that determined the positive effect of speed-power abilities on the indicators of switching the attention of schoolchildren with different nervous system strength. The results of the study allowed us to achieve this goal and determine the effectiveness of the conducted pedagogical experiment.

### Limitation and recommendation

The choice of the number of students was limited by the number of children in the classes and their medical admission to physical education classes. The results of the study can be used in working with children of different ages and genders. The use of the typological criterion in differentiating children into subgroups can be used in a regular school or in sports sections.

### Conclusion

If you perform exercises at each lesson in school that are aimed at developing speed and strength abilities in schoolchildren aged 13–14 years, then their indicators of attention switching will improve. It is important to note that physical activity for children should be different depending on the strength of the nervous system of schoolchildren. For schoolchildren with a strong nervous system, an intensive load is more typical (frequent changes of exercises and less number of series), and for schoolchildren with a weak nervous system – a volume load. The study is promising for further discoveries of the interaction of physical qualities and mental processes of children of different ages in physical education classes or in sports.

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### Conflicts of interest

There are no conflicts of interest.

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