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RESEARCH ARTICLE

The Effectiveness of Impact of Physical Activity on the Thinking Indicators of School Children

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Abstract:

Purpose:

The purpose of this study is to determine the influence of physical activity in physical education classes on the thinking indicators of schoolchildren.

Methods:

This was a cross-sectional study conducted in a secondary school number 60 in Kirov (Russia), attended by ninth graders aged 15-16 years (141 schoolchildren). The main method of research was the test "Cross out an extra word", which determined the level of development of students' thinking. The test was used before and after the physical education lesson 1 time per month for 5 months. Statistical analysis used: The student's T-criterion was used in the study.

Results:

The children who did not exercise, but completed the test, were able to only slightly improve their performance. This trend is observed every month. The indicators improved on average from 2.1% to 4.3% ($p > 0.05$).

The situation is different for children who were engaged in physical education lessons. In each of the five months, the test indicators improved significantly, on average, from 14.2% to 18.8% ($p < 0.05$).

Conclusion:

Physical education likely has a beneficial effect on the thinking of schoolchildren. This study will serve as an additional motivation for children to engage in physical activities, since physical exercises contribute not only to the development of physical qualities, but also to the development of schoolchildren's thinking.

Keywords: Health, Physical culture, Physical exercises, Mental processes, Students, Physical activity.

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1. INTRODUCTION

The topic of children's health and development is always relevant [1 - 4]. From early childhood and throughout life, people try to make health stable, stable to the effects of adverse factors. Of course, this is achieved in many ways. For example, there is such a thing as a healthy lifestyle. It includes such components as:

- (1) Physical activity.
- (2) Proper nutrition.
- (3) Healthy sleep.

(4) Giving up bad habits.

(5) Some other factors.

Such a classification is offered by a fairly large number of studies. At the same time, the percentage of components practically does not change. However, none of the researchers put physical activity in the last place in importance, noting its value for human development and health [5 - 9].

Unfortunately, children who enroll in colleges and universities after school are increasingly having health problems [10, 11]. At the same time, these are not only congenital problems and pathologies, most of them are acquired health problems, such as obesity, hypertension, that is,

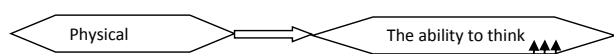
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for the most part, a consequence of a sedentary lifestyle [12, 13]. At the same time, a sedentary lifestyle since childhood leads to an increase in chronic diseases, a decrease in functional and physical fitness [14 - 16]. Thus, it is important to form children's desire and needs for physical education and sports from childhood [17].

One of the most important tasks of physical culture is the development of motor skills [18 - 20] and increasing the level of physical fitness [21, 22].

Physical education lessons at school are indispensable tools for implementing such a component of a healthy lifestyle as physical activity. A lesson at school is mandatory to attend and is conducted under the influence and supervision of a teacher [23]. Quite a large number of studies were presented on the benefits of physical education lessons at school. First of all, this is the development of physical qualities (strength, speed, motor abilities, endurance, flexibility, and others). The authors note the effectiveness of a particular methodology, school curriculum for the development of physical qualities of school children of different genders and ages [24 - 27].

Some studies mention that physical activity has a positive effect not only on the development of physical qualities but also on the development of cognitive and some mental processes [28 - 31]. It is known that physical exercises have proved to be an effective means for developing the creative abilities of schoolchildren [32 - 34].



The purpose of our study is to determine the influence of physical activity in physical education lessons on the thinking indicators of schoolchildren. Perhaps this would serve as an additional motivation for schoolchildren to take physical education classes at school, college or university.

2. MATERIALS AND MEHODS

2.1. Participants

The study involved ninth grade students of secondary school number 60 (Kirov, Russia), aged 15-16 years. A total of 141 students took part in the pedagogical experiment. The 9th grade students are graduates of the school and treated the study with maximum responsibility. All exercises and tests were performed consciously. The pedagogical study involved children regardless of gender, weight and height and level of physical fitness. Children with basic and preparatory health groups were admitted to physical education classes by the doctor.

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.

2.2. Procedure

The study was conducted for five months (January – May 2022). According to the schedule, physical education classes in the ninth grade were held 2 times a week for 45 minutes according to the physical education curriculum at the school

for children of grades 1-11 [20].

In our study, the main fact was the active physical participation or non-participation of the student in the process of physical education. Therefore, only the impact of physical activity of schoolchildren on their thinking indicators was considered. All physical exercises were performed under the supervision of a physical education teacher.

2.2.1. Step 1

Before the start of the physical education lesson, all children sit in a regular classroom and, at the teacher's command, perform a test: "Cross out an extra word" [35]. Testing was conducted in order to assess the current level of thinking.

The essence of the test:

There are 30 lines of 5 words in each line in front of the student. At the same time, 4 words are related in meaning, and the fifth word is different from the others. The test fragment is presented in the form of Table 1. There is an extra word "milk" in the first line, it needs to be crossed out. Within one minute, you need to cross out as many unnecessary words as possible. Each time the words in the lines changed. As a result, the teacher counts the number of correctly crossed-out words. If a student manages to cross out 12 extra words correctly within a minute, then his indicator = 12.

Table 1. Fragment of the test "Cross out an extra word".

1.	Apple	Orange	Banana	Milk	Peach
2.	Airplane	Bread	Bicycle	Ship	Car
3.	Table	Chair	Wardrobe	Bed	Toy
4.	Football	Painting	Hockey	Volleyball	Basketball
5.	Door	Keyboard	Monitor	System Unit	Printer

2.2.2. Step 2

All children go to physical education classes.

Children who are not allowed to the lesson for health reasons or other reasons do not perform the load, they are only present at the lesson. Students who are admitted to the physical education lesson are engaged in the lesson and perform physical activity according to the standard physical education program at school. Physical education of children plays an important role in their life and health:

(1) Strengthening the health and hardening of the human body, promoting proper physical development and improving performance.

(2) formation and improvement of motor skills and abilities.

(3) Development of basic motor qualities - strength, speed, endurance, flexibility and agility.

(4) Formation of habits and sustained interest in systematic physical exercise.

(5) Education of hygiene skills, communication of knowledge in the field of physical exercises and hardening.

(6) Formation of organizational skills.

2.2.3. Step 3

After the physical education lesson is over, all the children go to a regular class and take the test again: “Cross out an extra word”. After the end of the physical education lesson, testing showed the influence of children's active activity on thinking indicators. It should be noted that the time interval (before and after the lesson) was not chosen by chance, since, during the day or week students carry out other activities that could affect the test results. For the accuracy of the result, the procedure was performed once in the middle of each month from January to May. All students took the test, including those who were not allowed to attend classes for one reason or another. Children who were not present at school on the day of the test were not included in the results.

2.3. Mathematical and Statistical Processing of Results

All the indicators of schoolchildren according to the test results were entered in an Excel spreadsheet. The average value of the indicators before and after the study and their percentage increase were determined, the reliability of the increase in indicators was determined by the Student's T-criterion ($p > 0.05$).

3. RESULTS

The study involved boys and girls in the number of 141 people, they studied in grades 9, at the time of the study the children were 15-16 years old.

Before the beginning of the physical education lesson and after its completion, all children passed the control test “Cross out an extra word”. The test results are presented in Table 2.

Table 2. Test results “Cross out an extra word”.

Month	Physical Education Lesson	Number of Children in Lessons	Test before the Lesson	Test after the Lesson	%	p
January	Engaged	118	14.1	16.1	14.2%	<0.05
	Not engaged	23	13.9	14.4	3.3%	>0.05
February	Engaged	124	14.2	16.3	15.1%	<0.05
	Not engaged	17	13.1	13.7	4.3%	>0.05
March	Engaged	128	12.5	14.6	16.7%	<0.05
	Not engaged	13	13.9	14.2	2.1%	>0.05
April	Engaged	120	13.6	16.2	18.8%	<0.05
	Not engaged	21	12.9	13.2	2.6%	>0.05
May	Engaged	123	13.9	16.2	16.2%	<0.05
	Not engaged	18	13.8	14.4	4.2%	>0.05

Table 2 shows the average data for groups of children who were engaged and were not engaged in physical education.

So, for example, children who were engaged in physical education, in January before the physical education lesson, on average, showed a result in the test “Cross out an extra word” 14.1 - the number of crossed out words. After the end of the physical education lesson, the indicators improved by 14.2% and amounted to 16.1 crossed out words. On average, over the 5 months of the study, children who were engaged in physical education improved their performance from 14.2% (the minimum result in January) to 18.8% (the maximum result in

April) ($p < 0.05$).

Children who did not exercise, but completed the test, were able to only slightly improve their performance. This trend is observed every month. The indicators improved on average from 2.1% to 4.3% ($p > 0.05$).

Such results of the pedagogical experiment indicate the effectiveness of the influence of physical exercises and physical education lessons on the thinking of schoolchildren

4. DISCUSSION

The purpose of this study was to determine the influence of physical activity of schoolchildren on their thinking indicators. The main conclusion of this study is that children who were engaged in physical education were able to significantly improve their thinking indicators. Of course, this indicates the effectiveness of the influence of a variety of physical exercises on the indicators of thinking. Children who did not do physical exercises in the physical culture lesson were not able to significantly improve their performance in the “Cross out an extra word” test. This can probably be explained by the fact that performing the test before the start of the lesson served as some kind of training or adaptation to it since all the children performed it again after the physical education lesson. This trend was observed throughout the study.

A review of the literature on the problem shows the relevance of the issue of children's health and development [1, 3, 36]. Physical education has a great impact on the sedentary lifestyle of children [8, 9, 37, 38]. Despite the fact that a fairly large number of studies prove the effectiveness of physical education lessons for the health of children and the development of their physical qualities [24 - 27], there are studies that speak about the impact of physical exercise on the development of cognitive processes [28, 30, 31] and creative abilities of children [32 - 34].

However, it is also important that physical exercises have an impact on some mental processes, which is confirmed by some studies conducted [39, 40].

In this study, for the first time, the influence of a physical education lesson at school on the thinking indicators of ninth grade students is investigated. During the study period, thinking indicators improved in each month, regardless of the goals and objectives of a particular lesson, whether it was athletics, endurance running, forward somersault or the use of outdoor games, or sports games as a means of physical culture in the lesson.

From a physiological point of view, in all likelihood, physical exercises increase the activity of metabolic processes [2, 5, 41]. Under the influence of physical exercises, blood circulation improves [42 - 46] as a result of which mental processes are mobilized.

The results obtained will serve as additional motivation for physical education classes, since in the process of motor activity, not only physical qualities develop, but also the thinking of children. This study is relevant and promising for further study of the health and physical activity of children at school, as well as its impact on mental and cognitive processes.

In the future, research should focus on the impact of

physical activity and physical activity in physical education lessons not only on the physical qualities of schoolchildren, but also on different mental processes of children of different ages.

5. LIMITATIONS

The study involved ninth grade students who were healthy and admitted by a doctor to physical education classes.

CONCLUSION

The role of physical education lessons in the health of schoolchildren has been investigated and proved. The study provided evidence that strongly suggests that physical activity can improve the thinking of schoolchildren. As such, he also contributes to the growing academic literature on the processes of personality change and their broader implications for public health [47 - 49].

AUTHORS' CONTRIBUTION

Data gathering and idea owner of this study, Study design, Data gathering, Writing and submitting manuscript. Editing and approval of final draft – Polevoy G.G.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by Ministry of Science and Higher Education of the Russian Federation.

HUMAN AND ANIMAL RIGHTS

No animals were used that are the basis of this study. All the human experiments were performed in accordance with the Declaration of Helsinki.

CONSENT FOR PUBLICATION

Informed consent was obtained from all parents of the children included in the study.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data sets and materials are available from the corresponding author [G.P] on request.

FUNDING

None.

CONFLICT OF INTEREST

The author declares no conflicts of interest, financial or otherwise.

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