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Pupils` Cognitive Activity Stimulation by Means of Physical Training

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The article presents the research results of the physical activity influence on the intellectual performance of high school students. The methods of experiments and standardized observation were used. The efficiency of the cognitive activity was assessed by "Proof test" technique of B. Burdon. Within the experimental class, the program of additionally organized physical activity was built with provision for the individually – typological characteristics (temperament) of students. The motivation dynamics of the physical education and sport classes was studied. The mathematical results` processing was carried out by means of the Student`s criterion.

Keywords: physical training, intellectual work capacity, motivation, pupils

INTRODUCTION

Relevance of the subject

The physical training and sports play an important role in the healthy lifestyle formation of an individual. Such value of the physical culture and sports actualizes the problem of the efficiency of students` physical education.

Many scholars and scientists paid attention to the problem of younger generation`s physical education. Even in 19th century, the hygienic direction of the physical education was rapidly developed in Russia. Such doctors and teachers as E. A. Pokrovskiy (1980), A. Ya. Gerd (1953), E. M. Dementiev (1891), N. V. Zak (1892), N. S. Filitis (1916), G. Yu. Yavein (1926) and others, well-known at that time, took part in the physical education direction`s development. But in the late 19 – early 20th centuries, while developing the theoretical concepts of the physical education, the educational direction, who`s founder was P.V. Lesgaft (1990), appeared. The humanistic ideals of the physical education gained its further development in the works of V. V. Gorinevsky (1927).

In times of Soviet Union existence, especially in the first years of its formation, the military – applied direction of the physical education was more developed, and that was caused by the ideology of younger generation` education, existing during that period. In the following years and up to the present time, G. B. Meikson (2011), G. F. Shitikova (1997), A. A. Guzhalovsky (1986), V. I. Lyakh (2011), K. Kardyalis (2005), V. K. Balsevich (1988), M. Ya. Vilensky (2013), V. N. Shaulin (2012), E. N. Litvinov (2012), V. M. Minbulatov (2008), R. K. Bikmukhametov

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(2003) and others have devoted their works to the problem of students` physical training improvements.

Problem statement

In spite of researchers` constant interest to the problem of physical training and education, there are still a lot of problems to solve in this area.

The physical education classes at school are often perceived as something minor, having the subordinate importance in relation to such academic subjects as mathematics, physics, literature and others. Taking into account the attitude of subject-teachers to the physical education classes, which are perceived as something optional, students often neglect them. Parents also, without having serious reasons, try to exempt their child from physical education classes. The research shows that, 74% of students don`t have the need in the physical education classes, and 12% of students are not confident in the necessity of that classes, and 86% of students don`t are not aware of the importance of physical education for the realization of the further life plans (Lubysheva, 2010). However, it's time to rethink the role of these lessons not only in the context of physical, but also in intellectual development of the students.

Traditionally it is believed that the purpose of the physical education consists in the pupils` physical qualities developing and strengthening their health. That is fair enough from the pedagogical and medical points of view. Not denying that fact, we would like to look at the school physical education from the psychological point of view: such approach allows enriching the common understanding of the physical education lessons` assignment. From this point of view, it turns out that the physical qualities development in an external result of the physical education. However, there is also no less important internal– psychological – result, existence of which in the physical education practice is not yet fully realized, and therefore the purposeful pedagogical activity on its achievement is absent in most cases.

The generally accepted view, that the physical culture should be mainly aimed at the pupils` physical qualities development (force, endurance, speed, sprint ability, etc.) and the healthcare effect achievement, greatly decreases the content of the concept itself. At the same time, the several components, essential for the real culture of the physical education, fade into the background. These include: the aesthetic attitude education to the physical culture, the value and observance of the hygienic rules, the ability to control the physiological condition, the possession of techniques and methods of the recuperation, the need for health strengthening, and therefore the interest and aspiration for self-study exercises. Especially it would be desirable to distinguish the culture of performing the movements and mastering any new motor actions among these components. From our point of view, the formation and the development of the psychological mechanisms of that component should be one of the main psychological and pedagogical aims of physical education at school. We support the holistic approach to the education (Nekhoroshkov, 2014; Oguz & Ataseven, 2016; Nekhoroshkov, 2015; Miller, 2002).

Let us dwell on two psychological aspects of the physical education: the first one reflects the activating influence of the physical exercises on the course of person`s various mental processes; the second one is connected with the formation of the psychological bases of the motor development, in particular with the development of pupils` psychomotor system. Considering that aspect the physical education is aimed at preparation the pupils` motor apparatus for mastering any new movement skills in the future employment activity, which is partially implemented in the classroom. However, in order to increase the efficiency of the physical education classes during its implementation process, it is necessary to carry out more purposeful and conscious psychomotor development of pupils.

Let us take a more detailed look at the first psychological aspect of the physical education. It is well known how important physical activity is in creating the favorable conditions for the human mental activity implementation. It serves as a means of remoting the negative emotional impacts and intellectual exhaustion, and therefore as the factor of intellectual activity stimulation. As a result of physical exercises we see the improvement of the brain blood circulation and the intensification of psychological processes providing perception, processing and reproduction of the information. Thus, the numerous data show that the physical exercises influence on the increasing of memory size and attention span, accelerating the solution of the basic intellectual tasks and hastening the vision and motor reactions. It should be noted that in spite of its great independent value, the mental processes activation is not among the courses, which are promoted by the various theories of the physical education. However, it is particularly important for the physical education classes at school, where pupils` mental exhaustion is often observed. Therefore, the pupils` activation of mental processes and preparation of nervous system for the active functioning in the further classes is, definitely, a priority.

The contradiction between the recognition of positive influence of physical exercises on the person psychics and its insufficient use in pedagogical process as a means of intellectual work capacity increase leads to the problem of the study of conditions by which the physical culture and sports will be seen as a factor, increasing pupils` intellectual work capacity and activating their cognitive mental processes in terms of intense (tense) educational process.

In this regard, the objective of the study is to identify and prove the conditions under which the physical culture and sports becomes a factor of increasing pupils` intellectual work capacity and activating their cognitive mental processes.

METHODS

Attention is one of the main psychological processes and influences on the assessment of the cognitive readiness of a child and the success of his educational activity. That is why we used the “Proof test” of B. Burdon (1895). That technique allows determining the fluctuations of attention, fatigue existence and pupils` “exercisability” in relation to the repetitive stimuli. Practically, there are no restrictions on application of a technique. For a pupil it is necessary to know the alphabet. For providing a test, it is necessary to have a special form and a stopwatch. The form represents a sheet of paper, on which the letters of Russian alphabet are randomly placed in lines. The pupil is offered to cross out either 2 or 4 letters in each line / at the discretion of a teacher. The time should be noted. Every 30 or 60 seconds / again at the discretion of a teacher / a pupil is asked to draw a line (mark) the place on the sheet, where he stopped at that moment. The total time of the assignment is 5 minutes. The instruction for a pupil: “You see the sheet with printed letters in front of you. The task is to look through line by line and cross out the letters / a teacher should call what letters should be crossed out; for example, A and Z, or A, M, K and Z. Any variant can be called. Every 30 seconds / or 60 seconds / I will say “Mark”. You should mark the exact place where you have stopped at the moment. Then go on viewing the lines, until I say, “Stop!” Try to work quickly and precisely. Begin”. The processing is made by imposing a key. The quantity of correctly crossed out and missed letters is counted. The calculation can be made either on separate minute or on all task in general. The result quantitatively expresses the Coefficient of accuracy and Coefficient of productivity. In the experimental class, the amount of daily physical activity in the first half of a day included 10-minute gymnastics before lessons and sports breaks during the lessons (2-3 minutes) for general motor exercises. In the control classes, according

to the standard program, only obligatory physical education lessons were conducted. During a year (1, 2, 3 terms) the experimental class had an additional lessons in extra-curricular time. For that purpose, the work on the formation and change of attitude to the physical education has been provided. At the same time we relied on the works of T. Sheehan (1965). He used such methods of teaching, which firstly affected the cognitive, and then the behavioral and emotional components. In addition we focused on matching sports with individually – typological personal features. Taking into account their individually – typological features and temperament, pupils were offered to visit sports sections organized at school. In some cases, the explanatory discussions with the parents were held for that purpose. The inability to select the type of sports activity prevents the formation the pupils` interest in physical exercises (Solntseva, 1980). The foreign researchers also admit the need of expanding the forms and types of physical activity, pupils` freedom to choose the activity, increase of advertising and promoting the healthy lifestyle, providing the mechanisms of active socialization through sports (Bain, 1994; EACEA, 2011; Ogurlu, 2015; Hendry, 1986; Bompa, 1995; Wiersma, 2000; Luke, 1991; Bartram, 2005).

It is known that the temperament affects the way in what a person realizes his actions, and does not affect its content. The temperament is displayed in the mental processes` features, affecting the speed of remembering and strength of recall, fluency of mental operations, stability and switching of attention. The similar conclusions are also received relating to the sports activity. Thus, L.S. Solntseva (Soltseva, 1980; Solntseva 1988) have investigated the relation between the speed and accuracy of a reaction on a moving object (what is substantially defined by the type of nervous system) and sports type. The highest speed of the response was observed in boxing, football and figure skating; slow responsiveness was observed in wrestling, swimming, gymnastics and track and field athletics. The skaters, boxers, football players showed the best accuracy of response, athletes and wrestlers – the weakest.

Therefore, it is necessary to consider pupils` individual features in order to maintain the interest in the physical education and consequently, high performance. The educational program should be supplemented by extra-curriculum activity and by involving pupils into the various sports sections, according to their individual features and temperament. That is why the experimental class was surveyed by the well-known IPE technique (Aisenk, 2011) in order to determine the individually – typological features and the type of pupils` temperament. Based on the available data on the speed and accuracy of response of the representatives of different types of sports, pupils of sanguine and choleric types (mobility of nervous processes, extraversion) were involved in additional lessons of volleyball, basketball and soccer; pupils of phlegmatic and melancholic types (inertness of nervous processes, introversion) were involved in additional lessons of wrestling, track and field athletics and gymnastics.

The examination of sports motivation using the technique of V.L. Marishuk (2010) and L.K. Serova (2010) was conducted within the experimental and control classes in the beginning and in the end of the year (2010). Standardized supervision allows determining a sports orientation by the following criteria: the expressiveness of achievement motivation, the participation in competitions, the nature of moral motivation (individual and collective), social reaction to the competition conditions, obstacles, difficulties. The rating is given on the 5-point scale (Webb et al., 1966).

Table 1. Sports motivation exponents

№	Observing characteristics	Conditional scores
1	Desires to participate in competitions, to win, to record the results. Group motivation clearly dominates the selfish one. Deeply aware of the social significance of sport. Motivated to overcome the most difficult conditions of competition	5
2	Tries to compete, to win, but quite satisfies with repeating earlier results. Group motivation dominates selfish one but they can oppose each other. Motivated to overcome difficult conditions of competition.	4
3	Participates in competitions without a lot of desire, but doesn`t refuse. Selfish motivation overcomes the group one. Complication of conditions, unexpected difficulties cause a negative attitude to the competitive activity.	3
4	Doesn't try to participate in competitions, looks for a reason to give up, agrees only when selfish and self-serving motives are expressed. Complicated conditions of competitions increase the negative motivation.	2
5	Refuses to take part in competitions.	1

The quantitative and qualitative analysis of the daily, weekly, quarterly dynamics of the pupils` intellectual work capability in terms of proof-samples taken before and after the classes in the beginning, middle and in the end of a week in the experimental and control classes.

RESULTS

The conducted research of the sports motivation with the methods of V. L. Marishuk and L. K. Serova (Metodiki, 1984) gave the following results:

Xp и Xt – the average of the conditional assessment (scores) of sports motivation in the experimental class before the experiment (Pre-test) and after (test).

Thus it can be noted that within the experimental class the significant changes have been made, as a result of the conducted extra-curricular work, while in the control class, the positive dynamics is not observed and the number of students, seeking for the reason to refuse the participation in the competition, increased as they have the negative sports motivation. That can be explained by the increase of the passive body mass, the development of the internal inhibition connected with the girls` pubertal growth stage and boys` greater focus on a particular professional activity, which reduces the interest in the physical education lessons in general, and the sports motivation in particular.

In the experimental class the statistic verification of the differences in the sports motivation maturity before and after the experiment was conducted by Student`s criterion and showed the following results: the arithmetic average of the conditional assessment of sports motivation in the experimental class = 2,8.

Table 2. The value of sports motivation before and after the experiment

Experimental class			**Control Class**		
Before experiment (№)	Conditional score	After experiment (№)	Before experiment (№)	Conditional score	After experiment (№)
2	5	16	3	5	3
5	4	6	4	4	4
8	3	2	10	3	8
7	2	1	5	2	7
3	1	0	2	1	2
Xp=2,8		Xt=4,5	Xcp=3,0		Xct=2,95

After the experiment = 4,5. The dispersion before the experiment = 1,12. The dispersion after the experiment = 0,65. Thus, Student`s t-criterion = 6,39. Comparing the t-criterion with the tabular value for the number of degrees of freedom d ng+nэ-2=25+25-2=48, we are convinced, that the calculated t-criterion is higher than the tabular value, even assuming the probable mistake (p=0,001). Thus, the conditional assessment of sports motivation before and after the experiment are statistically and authentically differs from each other in terms of the positive dynamics.

As a matter of fact, the tiredness reveals itself in the reduction of full-value mental functions and, consequently, the decrease of the productivity. Such attributes as the reduction of the average number of traced letters, the increased number of mistakes, the reduction of the number of well-made samples as well as the increase of bad-made samples (accordingly, the reduction of P-coefficient) are taken as an indicators of the fatigue. The decrease of P lower than 1 (i.e. the prevalence of bad samples on good) serves as the criterion of the anxious condition. In addition, the coefficient of the productivity of Proof test (PPT) should be calculated to assess the performance quality of the sample. The following formula should be used: PPT=L/ (O+1)x10, where L is the average number of tracked letters, and O is the average number of mistakes per 500 signs.

The research data analysis shows the similarities and the differences in the dynamics of pupils` intellectual work capacity in experimental and control classes (distinctions are significant at p<0,01 on Student`s criterion).

The pupils` daily performance with the relatively high physical activity is more often higher before the lessons, and lower after the lessons. However, by the end of the year and in the 3rd term the work capacity is higher after the lessons than before.

The mental performance during the academic year has its own characteristics. In the 3rd term we observe the falling of the productivity of the proof test in the control class. It is the longest and tiresome term for pupils (January, February, March), when the internal resources are already depleted and pupils have a vitamin deficiency after the autumn and winter. At the same time, the high performance growth is observed in the experimental class (PPT varies from 0,93 to 1,02). In our opinion this is the result of the experimental work, as we organized the increased physical activity for the experimental class. In the 2nd term (November, December) the productivity of the Proof test doesn`t practically change before and after the lessons. There is a high incidence rate of pupils during that term (late autumn, beginning of winter) as the cheerfulness and energy, received in summer, ends. All that aspects reflect the quality of the work with the alphabetic tables and therefore, the work capacity. In the control class the lowest work capacity (PPT = 0,48) was received in the 1st term. In the second term it raised up to 0,69 but was still lower than the initial level (0,84).

Thus, the pupils` intellectual work capacity in the experimental class grows steadily throughout three term of the academic year. In the control class the high performance after the lessons is observed only in the 2nd term. By the end of the year, in the 3rd term, it considerably decreases after the lessons, which shows the accumulation of fatigue, the decrease of work capacity and full-value cognitive functions, such as the property of attention.

Table 3. Productivity of Proof-test (PPT) of pupils of experimental and control classes

	1 term		2 term		3 term	
	Before lessons	After lessons	Before lessons	After lessons	Before lessons	After lessons
Experimental class	0,6	0,49	0,71	0,73	0,93	1,02
Control class	0,84	0,48	0,62	0,69	1,23	0,68

CONCLUSIONS

1. Increase in daily motor activity of students has a positive effect on maintaining their mental performance during the school year and the prevention of fatigue - to its end . Its dynamics in these children compared with those students who have a normal school driving mode , characterized by a certain stability throughout the school year and the trend to an increase in workload and some increase in quality.

2. An important condition for improving the efficiency of lessons of physical training is to organize a large number of sports clubs , clubs at school or in the immediate neighborhood . This gives students the opportunity to select the kind of sport in accordance with their interests and individual - psychological characteristics. In turn, this fact develops sports motivation of students and increase their interest in mandatory lessons of physical culture in the school .

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