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
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Methods of Development of Physical Qualities of Schoolchildren of the Sixth Grade Depending on the Volume of the Physical Activity

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Abstract

Study aim. The purpose of the work is to describe special aspects of the experimental methodology for the development of physical qualities of schoolchildren of the 6th grade depending on the exercise load. In the context of the educational reform in Ukraine, physical education is of great importance since it is an integral element of the general human culture and one of the determinant indicators of national progress and health of the Ukrainians. Physical education is of special significance for schoolchildren in the course of formation of their health, promotion of healthy lifestyle culture, and harmonious physical and spiritual development of the rising generation.

Research methods: theoretical analysis and generalisation of the scientific and methodological literature, pedagogical monitoring, testing, pedagogical experiment, mathematical statistics methods.

Results. The most favourable period for the development of schoolchildren's strength has not been specified yet. According to some scholars, the most appropriate period for boys' strength development is 13-14 to 17-18 years, whereas for the girls it ranges from 11-12 to 15-16, while the muscle percentage in the overall body mass considerably varies depending on the age (it is approximately 23.0 % until the age of 10-11; 33.0 % at the age of 14-15 and up to 45.0 % at the age of 17-18). At the same time, the total body mass increases during this period as well, so the growth of relative strength is not considerable, especially for female pupils. Therefore, the most considerable rates of growth of relative strength of different muscle groups is demonstrated by the pupils of the 3rd, 5th and 6th grades.

Conclusions. The experimental results of the research demonstrate that the strength qualities are mostly subject to the targeted impact during the given school periods. The highest absolute strength indicators of different muscle groups are demonstrated at the age of 25 to 30, though. At the same time, it is known that there are numerous cases in the sport when the maximum level was reached by boys and girls aged 15-16 and 17-18. It is still important to take into consideration morphofunctional abilities of the growing organism in the course of strength development.

Keywords: educational motivation, physical education, differentiated approach, physical qualities, pupils

1. Introduction

The urgent need of changes in educational program approaches and determination of priorities of the development of physical education in schools, as well as the shift in emphasis under new socio-economic conditions, led to the adoption of the following regulatory documents: the Law of Ukraine "On Physical Culture and Sports", National Doctrine of Physical Culture and Sports in Ukraine, the Order of the Council of Ministers of Ukraine of 31 August, 2011, № 828-r "On Approval of the Concept of the National Target Social Program for the Development of Physical Culture and Sports for 2012-2016", as well as the Order of the Ministry of Education and Science of Ukraine: "On Methods to Improve the Work on Physical Education and Preservation of Schoolchildren's Health in Educational Institutions of Ukraine", "On the Mode of Work of Educational Institutions", the Order of the Council of Ministers "On Approval of the Concept of The National Targeted Social Program "Healthy Nation" for 2009-2013", etc., according to which the strategic goals of the physical education system of children and youth are the formation of their physical, moral and psychological health, building an awareness of the need for physical improvement and motivation for the development of interest and habit of independent physical exercises by culture and sports.

2. Literature Review

As Y. A. Kompaniets (2013) notes, nowadays, physical education, sport activity, physical culture are complex, multifactorial, multifunctional social phenomena. The current priority is not only formation of a healthy, spiritually developed personality, but also preparation of youth for participation in hostilities. In addition, the beginning of the twenty-first century is characterized by the need to compensate the adverse effects of hypodynamia and hypokinesia on pupils' and students' organisms. In this article we investigated the influence of experimental method of physical education on sixth-grade pupils of Kyiv secondary schools. The study was conducted with the schoolchildren of secondary school № 303 and the V. Sukhomlynskyi Ukrainian College. The experimental group included students of the secondary school № 303 (EG, n - 56 boys and 55 girls), while pupils of the V. Sukhomlynskyi Ukrainian college were the control group (CG, n - 52 boys and 50 girls). Obtained results, in particular, indicators of physical fitness, proved that results of pupils of EG are probably better than those of CG ($p < 0.05-0.001$), which confirms the effectiveness of the experimental methodology.

The system of physical education in secondary educational institutions should be a reliable base for a high level of mental working capacity and intellectual development of students under the process of learning, involving them in systematic physical activity, forming the need of physical development and improvement to ensure a high level of health and professional longevity [7; 11; 12; 13; 15].

The educational process of physical culture in secondary school is aimed at achieving basic general secondary education, which implies the development and socialization of students, formation of their national identity, general culture, ideological orientations, ecological style of thinking, behavior and also the abilities of research and life affirmation, self-development and self-learning under global changes and challenges. The increase of motor activity of pupils, which is provided by modern regulation documents, would seem to improve the situation, but an increase of the number of schoolchildren who are classified in special medical groups, points out the need for new approaches in solving this problem.

To substantiate the criteria of the differentiated contents of exercise load in one of the 6th-grade physical education courses in the school program, the results of several studies on successful development of motor activity, organism growth and development of schoolchildren were studied. The present-day scientific research data and methodological solutions related to differentiated physical exercises for pupils of secondary schools were also analyzed, systematized, and generalized.

3. Method

3.1. Participants

To study the development of physical qualities in schoolchildren of the 6th grade, we engaged the schoolchildren of secondary school № 303 (experimental group) and V. Sukhomlynskyi Ukrainian College (control group). The experimental group was engaged in sport activities based on the experimental methodology whereas the control group exercised in accordance with common physical education programme. The total number of the schoolchildren participating in the study was 213 persons.

3.2. Materials

To find out the efficiency of the experimental methodology as compared to the common programme, we used such exercises as standing long jumps for boys and girls, pull-ups for boys and pushups for girls. 60-m, 1,000-m and 1,500-m runs were used to assess the development of physical qualities of speed and stamina. To develop stamina, the schoolchildren in the experimental group performed moderate-intensity work (approximately 50% of the maximum load). The conditions of physical exercise of such intensity promoted the development of stamina, which, in turn, mainly depends on the aerobic capacity of the organism. During such work, functional activity of muscles, other organs and tissues are oxygenated the most. The heart rate during loads of this intensity reached 130–160 beats per minute. The schoolchildren's exercise of the moderate intensity promoted the interaction among the functions of the cardiovascular system, breathing and motor apparatus. It was proven by the research that the maximum time of the schoolchildren's work of such intensity (50.0 %) was 19-20 minutes on average.

3.3. Procedure

The experiment was conducted during the school year. The experimental methodology for physical education lessons was used at the positive emotional background as well as with account of the health condition, level of physical fitness and gender. Furthermore, the schoolchildren in the experimental group did sport in the parkland three times a week in addition to two physical education lessons in the school schedule. The basis of these additional lessons was a recreational run along the "Health path", as well as different physical exercises at the gymnastic apparatus located on the "stations" (sport grounds) of the "Health path", which are located along the path at certain distance from each other. Such lessons considerably increased children's exercise motivation.

That is the fundamental difference between the examined methodology and the generally accepted program of physical culture as simple increase in the number of hours of physical education does not give positive results. That was shown by the numerous results of the scientists [1; 2; 3; 4; 5; 8]. For conducting this experiment during sport lessons, we used the following methods: a word method, a method of circular training, a method of combined exercise with different combinations of task structure, an interval method, a method of continuous variational exercise, a game method, etc. Therefore, the difference between proposed experimental methodology and generally accepted physical culture program at schools lies not only in the increase of a number of hours, but also in the peculiarity of the methodology of conducting training sessions.

Objectives:

1. To determine the impact of differentiated loads on the physical fitness of secondary school pupils (on the example of the 6th grade).

2. To carry out experiments to check the efficiency of the proposed experimental methodology for the development of strength and stamina of schoolchildren of the 6th grade.

Research methods: theoretical analysis and generalisation of the scientific and methodological literature, pedagogical monitoring, testing, pedagogical experiment, mathematical statistics methods.

4. Results

To find out the efficiency of the experimental methodology as compared to the common programme, we used such exercises as standing long jumps for boys and girls, pull-ups for boys and pushups for girls. As of the beginning of the academic year, the boys in the control group had an advantage when performing standing long jumps (162.9±2.37 cm against 162.5±1.53 cm against the boys in the experimental group). However, this advantage is not confirmed by the statistical probability ($p > 0.05$). The results of research into the development of strength and speed and strength qualities are given in Tables 1-2.

Table 1. Comparative characteristic of indicators of speed and strength, and strength qualities of boys of the 6th grade subjected to the physical load during the academic year

Research group	Statistical indicators	Test exercises					
		standing long jumps, cm			pull-ups, reps		
		beginning of the academic year	end of the academic year	p	beginning of the academic year	end of the academic year	p

Experimental group, n-56	M	162.5	172.3	0.001	1.96	3.85	< 0.001
	±m	1.53	1.59		0.25	0.26	
Control group, n-52	M	162.9	168.6	0.01	2.39	2.10	> 0.05
	±m	2.37	1.53		0.41	0.33	
Statistical probability	p	>0.05	<0.02		>0.02	<0.001	

As of the end of the academic year, results of the boys in the experimental group performing standing long jumps improved greatly against the results of the boys in the control group (172.3±1.59 cm against 168.6±2.53 cm against the boys in the control group), which is confirmed by a statistical probability ($p>0.02$). At the same time, if we compare the dynamics of boys of the control group, at the end of the school year they had a positive dynamics, which is confirmed by a statistical probability ($p>0.01$).

Table 2. Comparative characteristic of indicators of speed and strength, and strength qualities of girls of the 6th grade subjected to the physical load during the academic year

Research group	Statistical indicators	Test exercises					
		standing long jumps, cm			pushups, reps		
		beginning of the academic year	end of the academic year	p	beginning of the academic year	end of the academic year	p
Experimental group, n-56	M	154.8	164.7	0.001	17.8	22.7	<0.001
	±m	1.89	1.51		1.08	1.13	
Control group, n-52	M	148.9	161.2	0.001	13.2	16.3	<0.02
	±m	2.19	1.23		1.19	1.35	
Statistical probability	p	<0.01	<0.01		<0.001	<0.001	

As for the pull-ups, the absolute indicators were better among the boys in the control group than in the experimental one (2.39±0.41 against 1.96±0.25) although it was not confirmed by the statistical probability ($p>0.2$). However, as of the end of the academic year, the indicators of the boys in the experimental group improved by 1.89 times whereas the ones of the boys of the control group decreased by 0.29 times. The advantage of the experimental methodology over the common one is confirmed by the high degree of statistical probability ($p<0.001$).

During the entire period of the research, the female experimental group had the significant advantage over the girls in the control group. Both as of the beginning and the end of the experiment, efficiency of the experimental methodology is confirmed by the high degree of statistical probability ($p<0.001$), but it should be noted that there were improvements in the results of the girls of the control group at the end of the school year, in particular, in the results of high-power and strength exercises with high degree of statistical probability ($p<0.001$) (Table 2).

At the same time, if the results of the research of the girls in both groups are compared, there is a considerable difference between them. Thus, as of the beginning of the academic year, the results of the girls in the experimental group were 154.8±1.89 cm whereas the girls in the control group had 148.9±2.19 cm. The positive dynamics of the girls in the experimental group is confirmed by the statistical probability ($p<0.01$). The situation remained the same as of the end of the academic year. The absolute results were improved by

the girls in both groups, but when they were compared, the advantage of the girls in the experimental group was evident (164.7 ± 1.51 cm against 161.2 ± 1.23 cm, $p < 0.01$). The results of the development of physical qualities of speed and stamina are presented in Tables 3-4.

At the beginning of the experiment, schoolchildren of the 6th grade in the control group had better speed indicators 10.7 ± 0.11 against 10.8 ± 0.09 of the boys in the experimental group ($p > 0.05$). On the contrary, the girls in the experimental group demonstrated better speed indicators (11.2 ± 0.09 against 11.4 ± 0.11 , $p < 0.05$).

As for the end of the academic year, the results of the boys in the experimental group improved considerably and were 10.1 ± 0.05 against 10.4 ± 0.11 of the control group ($p < 0.001$). As of the end of the academic year, the girls in the experimental group were able to improve their indicators (10.6 ± 0.07). The girls in the control group also improved their results (11.0 ± 0.11), but they had worse results in comparison with the experimental group, which was confirmed by the high degree of statistical probability ($p < 0.001$).

The same pattern is observed in relation to stamina indicators (1,000-m and 1,500-m races); the experimental group demonstrated better results in both test exercises both at the beginning and end of the research. In particular, as of the beginning of the academic year, the boys in the experimental group demonstrated the following result in running 1,000 m: 4.41 ± 0.05 minutes, against 4.59 ± 0.09 in the control group, $p < 0.001$; as of the end of the academic year, the results of the boys in the experimental group were also better and made up 4.10 ± 0.03 minutes against 4.57 ± 0.06 in the control group. The advantage of the boys in the experimental group over the boys in the control group is confirmed by the high degree of statistical probability ($p < 0.001$).

The results of 1,500-meter run were similar: schoolchildren of the experimental group showed better results than schoolchildren in the control group both as of the beginning and as of the end of the academic year, which was confirmed by the high degree of statistical probability ($p < 0.001$).

Table 3. Comparative characteristics of speed and stamina indicators of boys of the 6th grade subjected to the physical load during the academic year

Research group	Statistical indicators	Test exercises					
		Running 60 m, s		Running 1,000 m, minutes, s		Running 1,500 m, minutes, s	
		beginning of the academic year	end of the academic year	beginning of the academic year	end of the academic year	beginning of the academic year	end of the academic year
Experimental group, n-56	M	10.8	10.1	4.41	4.10	7.23	6.53
	$\pm m$	0.09	0.05	0.05	0.03	0.11	0.10
Statistical probability	p	<0.001		<0.001		<0.001	
Control group, n-52	M	10.7	10.4	4.59	4.57	7.55	7.52
	$\pm m$	0.11	0.11	0.09	0.06	0.14	0.11
Statistical probability	p	<0.01		>0.05		>0.05	
General statistical probability	p	>0.05	<0.001	<0.01	<0.001	<0.02	<0.001

Table 4. Comparative characteristics of speed and stamina indicators of girls of the 6th grade subjected to the physical load during the academic year

Research group	Statistical indicators	Test exercises					
		Running 60 m, s		Running 1,000 m, minutes, s		Running 1,500 m, minutes, s	
		beginning of the academic year	end of the academic year	beginning of the academic year	end of the academic year	beginning of the academic year	end of the academic year
Experimental group, n-56	M	11.2	10.6	5.14	4.56	8.24	7.25
	±m	0.09	0.07	0.08	0.07	0.09	0.10
Statistical probability	p	<0.001		<0.001		<0.001	
Control group, n-52	M	11.4	11.0	5.56	5.50	9.27	8.16
	±m	0.11	0.11	0.17	0.12	0.18	0.14
Statistical probability	p	<0.001		>0.05		<0.001	
General statistical probability	P	<0.05	<0.001	<0.01	<0.001	<0.001	<0.001

The effectiveness of the use of experimental techniques in running exercises was also observed in the experimental group of girls. In particular, the best results of girls in the experimental group on 60-m, 1,000-m and 1,500-m runs at the beginning, as well as at the end of the school year, significantly exceeded the results of the control group, as evidenced by the high degree of statistical probability (from $p < 0.05$ to $p < 0.001$). In addition, girls of the control group showed positive changes in the dynamics of the test exercises at the end of the school year, which was confirmed by a high degree of statistical probability ($p < 0.001$), except for the results of 1,000-m run, where improvement was not confirmed by statistical probability, but showed only a noticeable tendency of results improvement ($p > 0.05$).

5. Discussion and Conclusion

Based on the analysis of the data from a number of sources [1; 4; 9; 10; 14; 16, 17, 18] and the results of the pedagogical experiment, the conclusion can be made that individual abilities of schoolchildren, their physical development, gender and physical fitness need to be taken into consideration in the course of development of strength qualities and stamina of the 6th grade pupils by means of the differentiated educational methodology.

Studies of the level of physical development and physical preparedness showed that the sixth-graders showed differences within their age group, both by individual indicators, and on the whole for 12-13-year-old children. Children develop a basic understanding of their physical and mental abilities at this very age [6; 7]. In the 5th and 6th grades, development of such physical qualities as strength, stamina, and speed is especially important.

According to T. Yu. Krutsevych (1999), speed is a complex movement quality including simple and complex forms of display of speed ability. Simple forms are displayed as the latent time of simple and complicated movement reactions, the speed of making a specific move, and frequency of moves. Complex forms of speed abilities of schoolchildren are displayed as complex movement acts typical of training and contesting activity in different types of sport and are provided with elementary forms of display of speed in versatile combinations and in aggregate with other motor abilities.

A. I. Poruchynskiy (1997) determines aiming accuracy as a complex psychophysical quality depending on the spatial, speed, and strength components, differentiation functions, and movement parameter reproduction.

Therefore, any level of display of speed ability is based on psychophysical displays, and the sensitive period of development thereof pertains to the primary and early secondary school age (12-13 years).

The contents of motor components were studied by V. P. Ozerov and Yu. O. Petrenko. It was proven by their research that sensory-motor skills regulate sensory reactions and sensory-motor coordination; motor actions are connected with awareness of task solution with movements; ideomotion discharges the programming and movement regulating function. Ideomotion combines natural abilities to design, reconstruct each future action in your mind and carry out the action. It is provided for by three types of thinking: symbolic, visual and action. Sensory motor abilities are controlled by sensory organs and muscles. Thus, V. P. Ozerov believes that the ability to manage time, space and dynamic characteristics is a sign of psychomotor development [3; 4].

At the current stage, the physical education is based mainly on the principles of age and gender differentiation of schoolchildren, their health and movement fitness, but intensity of biological maturity of the organism, special aspects of physical development (body length and weight), development of psychological traits, and somatometric indicators are hardly taken into consideration. Therefore, age and gender are common factors used to develop the training programme for movement abilities and skills.

It has been proven that one of the dominating factors of change in schoolchildren's physical fitness indicators is the type of constitution, the height, the girth of the body and its weight. Thus, schoolchildren having a longer and heavier body are better at throwing but have much more difficulty in endurance running. Schoolchildren of smaller body dimensions succeed in cyclic exercises demanding stamina, whereas relatively tall and light schoolchildren are better than others in a jumping exercise in the track and field area.

Increased speed of children in secondary school is known to be mainly associated with the high movement rate in the course of running. In their studies, V. L. Volkova, B. M. Shyian, and S. I. Prysiashniuk determined optimum age period of development of different displays of speed, speed-strength, and strength qualities and stamina. The term of school training is the most suitable for the development of children's strength qualities. Over 10-11 years of school, strength indicators of the basic muscle groups are improved by 200-500 % and more (V. I. Liakh, 1997). The strength indicators of the large muscles of the trunk, thigh, lower thigh and foot grow at the highest rate.

The assessment of the level of physical development and fitness demonstrated that the schoolchildren of the 6th grade showed the uniqueness of the age group, both based on specific indicators and in general, among children aged 12-13. Existing individual differences between boys and girls with the different level of physical development and fitness are a basis for the development of differentiated recommendations during physical education of schoolchildren. Use of the individual approach to the determination of the physical load depending on the physical development, gender, health and physical fitness enables to increase the efficiency of the physical educational process in the secondary school.

Application of the experimental methodology at physical education lessons as well as an additional physical exercise in the parkland enabled increasing the weekly load on the schoolchildren of the 6th grade up to eight hours and improving indicators of development of their physical qualities considerably, whereas weekly physical activity of pupils of the control group was only 2-3 hours.

Therefore, the results of the research among the schoolchildren of the 6th grade confirmed high efficiency of the experimental methodology in comparison with the common physical education culture having two or three physical education lessons per week only.

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