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Formation of Complex System of Educational and Training Tasks in Physical Education of 13-14 Years Old Schoolchildren

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ABSTRACT

The article deals with the results of study of the formation of complex system of educational and training tasks in physical education of 13-14 years old schoolchildren. The scheme of analysis of physical qualities due to the types of their manifestation, which gave the opportunity to distinguish 16 relatively independent components, has been developed. This contributes to the concretization of training focus of physical qualities comprehensive development. The program of detailed development of physical qualities, which provides purposeful continuous influence on all types of manifestation of physical qualities by combining separate training tasks in such a way that their minimal number could provide improvement of all factors that determine the manifestation of general motor activity of schoolchildren, has been substantiated. It has been formed the methods of complex solution of educational and training tasks that provide a comprehensive development of physical qualities, is consistent with the training essence of studying exercises and finding of adequate means for the complex solution of educational and training tasks. The results of the experimental verification of effectiveness of the developed educational-training program, which showed reliably significant changes in the level of physical preparedness, somatic health and technical preparedness of teenagers, have been presented.

1. Introduction

Measures taken at the state level to improve the physical condition of schoolchildren will not be able to provide positive changes without searching ways to optimize physical education in a secondary school [1; 2; 3; 4]. The leading place in this process takes the implementation of the regularities of body adaption of schoolchildren to moving activity [5; 6; 7].

A it is known the purpose of physical education is achieved by solving the tasks, which are conventionally divided into educational and training [8; 9]. A special relevance these tasks acquire in adolescence, which is the period

of maximum rates of natural development of almost all systems of organism [10; 11; 12].

At the same time there is no single position in determining the number of manifestations of physical properties that are available to a person relative to independent that limits the complete comprehensive development of motor functions in the theory of physical education [13; 14; 15]. Also it is a problem to provide selective influence in the process of simultaneous development of the whole complex of motor functions, such as using the phenomenon "positive transfer" in the development of motor qualities nowadays is not sufficiently methodologically substantiated [16].

They proved the necessity in concretization of educational tasks at every lesson [17], found the decisive role of proper motor experience, developed the theory of adaptive study [18], also substantiated the idea of complex approach for solving educational and training tasks [19; 20; 21]. Along with this, the advance development of necessary physical qualities in the context of their comprehensive development has not found its proper scientific substantiation.

Analysis of literature [13-15; 22; 23] allowed distinguishing biological foundations for the formation of long-term adaptation and logical constructive functions of the teacher, directed on their implementation. A weak link in the system of these functions is the formation of complex system of educational and training tasks that determines the orientation and structural orderliness of the educational and training process, performing the role of its system-forming basis.

Thus, the relevance of our research is determined by the decisive meaning for effective physical education of schoolchildren of the methods of formation of complex system of educational and training tasks on the one hand and the lack of its scientific substantiation on the other hand.

2. Materials and methods

The following methods were used in the research: theoretical analysis and generalization; method of predictive scenario; physiological methods of research; pedagogical control test for identifying the level of physical preparedness; expert evaluation; pedagogical experiment; method of mathematical statistics.

2.1. Purpose of the study

The purpose of research is to develop scientifically substantiated technologies of formation of complex system of educational and training tasks in physical education of 13-14 years old teenagers. The tasks of research are: to make an analysis of physical qualities by the types of their manifestation; theoretically substantiate a technology of formation of system of training tasks for the full development of physical qualities; to form a system of educational tasks for assimilation of motor activities by 13-14 years old adolescents; to form a complex system of educational and training tasks for assimilation of motor activities coordinated with the comprehensive development of physical qualities and find adequate means of its realization in physical education of 13-14 years old adolescents; experimentally check its efficiency.

2.2. Participants

Pedagogical experiment was conducted in the Ternopil secondary school № 28, which is characterized by a favorable material and technical base for making the experiment: three gyms, football stadium with racetracks 400 m, different standard and non-standard sports equipment and gear. The study was attended by 112 pupils of the eight grades of 13-14 years old, including 62 boys and 50 girls. All schoolchildren belonged to the main medical group and at the time of the experiment were practically healthy. None of them often constantly visited sports sections. Two

homogeneous groups have been formed of the four examined classes: control (32 boys and 24 girls) and experimental (30 boys and 26 girls).

2.3. Measures

The level of physical preparedness of pupils was determined according to the school complex test and with a help of additional tests. They included: Shuttle Run 4x9 m; run 60 m; long jump; bending and unbending arms in the lying emphasis (push-up); pull-up on a cross-bar; run 2000 m; tilt of the body forward in sitting position; frequency of hands movements; pushing a medical ball 4 kg; jerk of load 7 kg; run 400 m; lifting into sit for 1 min (press); squats on one leg; keeping half sitting; hanging with bent arms; stretch lying on bended arms.

Also it was carried out a thematic evaluation of pupils study achievements, which included the following control standards: run 400 m; run 60 m; football (group tactical actions); high jump with crossing; throwing of small ball; throwing of grenade.

To identify the level of somatic health of pupils we have used method of express evaluation [24]. This method includes definition of anthropometric and functional indicators and their indices. The physiometric indicators include: life capacity of lungs (LCL); heart rate (HR); arterial pressure (AP); wrist muscle strength. Measurement of the physiometric indicators was carried out by the following devices: dynamometer (wrist muscle strength); stopwatch (HR); spirometer (LCL); sphygmomanometer (AP). On the basis of the physiometric indicators, such indices were calculated: Robinson index (functional state of the cardiovascular system); Ruffier index (time of renewing HR after 20 squats for 30 seconds); life index (correlation of life capacity of lungs to body weight); power index (correlation of absolute force index, fixed on the wrist dynamometer, to body weight).

2.4. Procedures

All measurements have been made by the authors of this publication. Thus, the obtained data are 100% original. The program we developed required an adequate approach to the method of physical preparedness testing. That is why the complex test, provided by the school curriculum, has been supplemented by our additional tests, which expanded the ability to identify the level of perfection of all aspects of motor readiness of schoolchildren. The assessment of study achievements of teenagers was carried out by expert evaluation after assimilation of each exercise. In order to activate activities of pupils a competitive method of organizing work was used. The evaluation was carried out by a twelve-point scale.

Choosing the method for determining the level of somatic health is due to the fact that it gives an opportunity to determine in a comprehensive way the functional state of organism according to indicators of the cardiorspiratory and muscular systems, which are formalized in quantitative units (points) and associated with the level of individual health. Using the automated computer program and on the basis of gender and age tables of formalized indices assessments, each indicator is rated in points. After that the total score is calculated, according to which the level of somatic health of pupils is determined. The total quantitative assessment in scores allows attributing pupil to a particular functional level: low (0-3 points); below average (4-6); average (7-11); above average (12-15); and high (16-18). Measurement in control tests at the beginning and at the end of the pedagogical experiment was conducted under the same pedagogical conditions.

3. Results

Into the basis of analysis of physical qualities according to the types of their manifestation was laid the scheme, which in general reflects the relationship between speed, power and endurance. They can be conditionally expressed in the form of an equilateral triangle (Fig. 1), the angles of which are marked as speed, power and endurance. Each vertex is characterized by qualitatively different external indicators, and, consequently, factors that determine their manifestation. In the transitions between the «clear» manifestations of physical qualities there is a gradual loss of features of certain qualities with the acquisition of features of others. A specific combination of them for each intermediate link indicates in this interval the presence of a certain independent form of manifestation of this or that physical quality. As a result of the analysis of motor qualities, we received 16 components of them. Only if they can be complexly improved, you can get a complete general physical preparedness of schoolchildren. Along with this condition is another – it is necessary to provide a sufficiently enough training effect on each of motor functions.

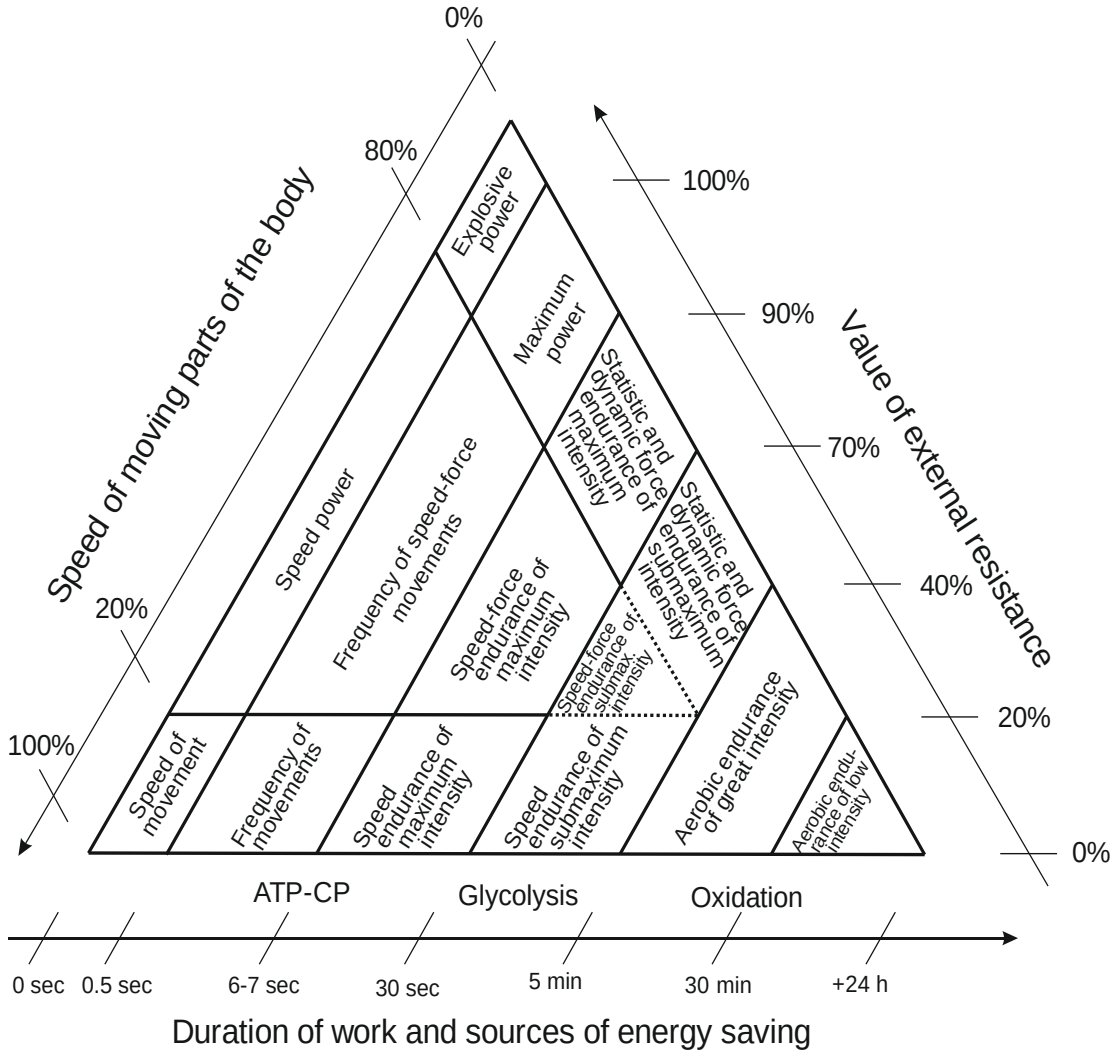

Figure 1. Varieties of manifestation of physical qualities

To achieve this by solving all training tasks is problematic, such as complex classes carry a big but not profound influence on the organism. That is why all the shifts caused by such work disappear in a day. Sufficiently enough influence on the organism can provide only selective focusing classes.

In our opinion, to solve the problem of versatile physical improvement provided that the selective orientation of classes allows the phenomenon of «positive transfer» in the development of various physical qualities. Its essence is that the development of one physical qualities positively influence at manifestation of others. In the base of this phenomenon is some commonality of internal factors of motor activity. To identify the character of relationship between different physical qualities we have identified the main internal factors of the organism, which can be responsible for each of them.

Table 1. Comparative analysis of factors of physical qualities manifestation

Factors, which predetermine manifestation of physical qualities / Physical qualities			Maximum power	Explosive power	Speed power	Speed of a single movement	Frequency of movements	Speed endurance		Aerobic endurance		Power endurance				Frequency of speed-force movements	Speed-force endurance	
								of maximum intensity	of submaximum intensity	of great intensity	of low intensity	of maximum intensity		of submaximum intensity			of maximum intensity	of submaximum intensity
												dynamic	statistic	dynamic	statistic			
Motor centers	Excitability			•	•	•												
	Lability						•	•								•	•	○
	Resistance to fatigue							○	○	○	○	○	•	○	•		○	○
	Intensity of excitation of MU		•	•	•							○	○					
Muscles	Contractile proteins		•	•	○							•	○	○		○	○	○
	Elasticity of muscles			○	•	○						○				•	•	○
Energy providing	Energy system ATP-CP	power	•	•	•	•	•									•		
		capacity						•				•	•				•	
	Glycolytic energy system	power						•				•	•				•	
		capacity						○	•			○	○	•	•		○	•
	Oxidative energy system	power							○	•				○	○			○
		capacity									•							

Note: • – expressive influence of the factor; ○ – less expressive influence of the factor

As a result of the analysis of Table 1 we have got the conclusion that in the basis of all 15 motor capabilities

are the eight major morphological and functional factors (Fig. 2). In this case, almost each of them is associated with two motor qualities. The complex of factors, which are responsible for human motor activity we have defined the term «general content of physical exercises».

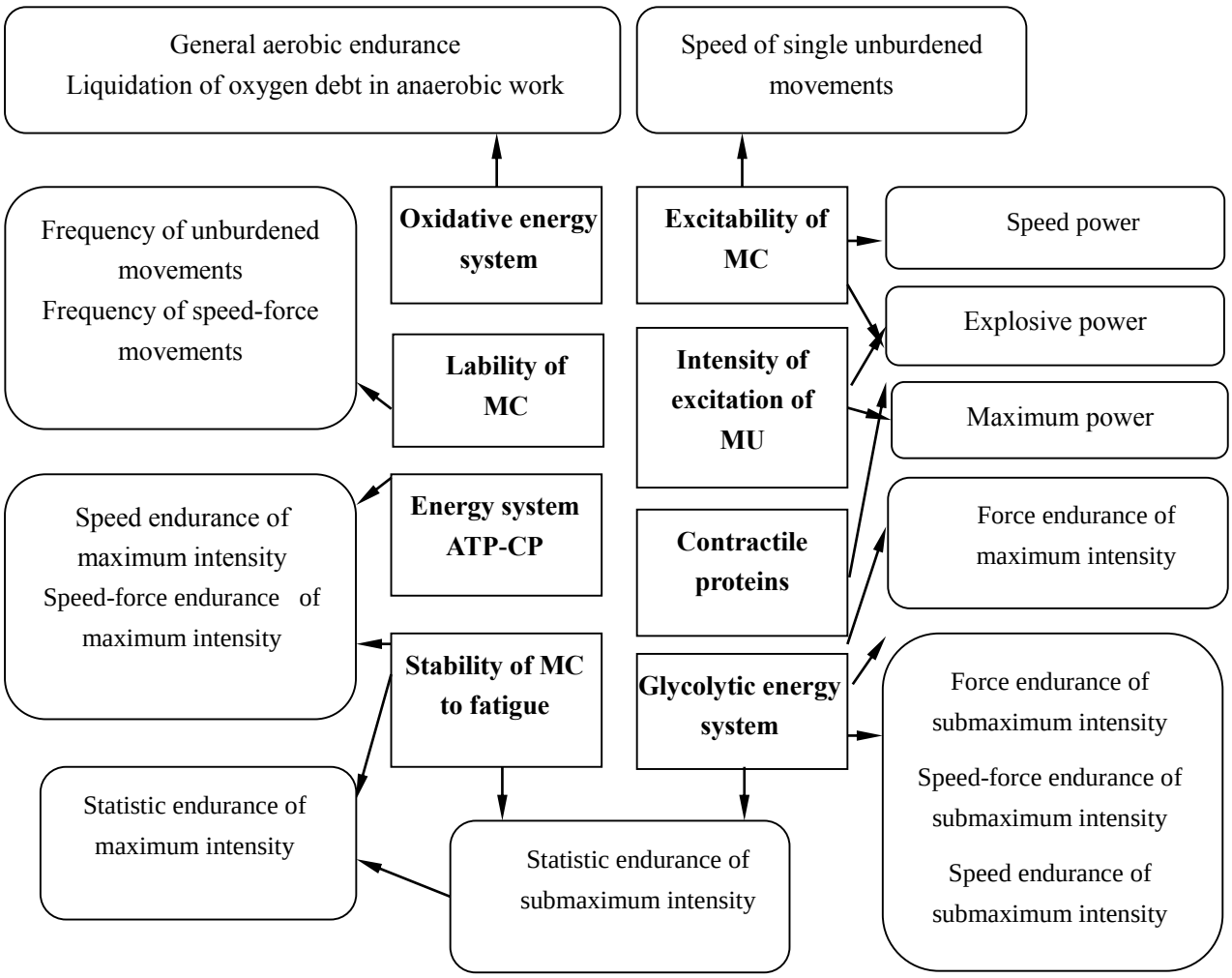

Figure 2. Unity of internal factors of various physical qualities

Note: MC – motor center; MU – motor unit; ATP-CP – Adenosine triphosphate-Creatine phosphate

It is on the improvement of these factors that our training methods are directed. We detected that training effect on the «general content of physical exercises» can be provided by setting up significantly less training tasks. Some separate physical qualities may be grouped in such way that their minimal set would provide training effect on the whole range of internal factors of versatile motor activities.

In order to get training effects on the mentioned factors we have identified about 27 combinations of training tasks for the full development of physical qualities, two of which are given in the Table 2.

Table 2. Combinations of training tasks for the full development of physical qualities

Factors, which predetermine manifestation of physical qualities / Physical qualities			№1					№2				
			Explosive power	Frequency of movements	Dynamic force endurance of maximum intensity	Statistic force endurance of submaximum intensity	Aerobic endurance	Speed power	Dynamic force endurance of maximum intensity	Statistic force endurance of maximum intensity	Speed endurance of submaximum intensity	Aerobic endurance
Motor centers	Excitability		•				•	•				•
	Lability			•							○	
	Resistance to fatigue				○	•			○	•	○	
	Intensity of excitation of MU		•		○		•	•	○	○		•
Muscles	Contractile proteins		•		•		•	○	•	○		•
	Elasticity of muscles		○		○		○	•				○
Energy providing	Energy system ATP-CP	power	•	•		•	•	•	○			•
		capacity			•				•	•		
	Glycolytic energy system	power			•				•	•		
		capacity			○	•			○	○	•	
	Oxidative energy system	power				○	•				○	•
		capacity					•					•

Note: • – expressive influence of the factor; ○ – less expressive influence of the factor

Considering the fact that the development of physical qualities at physical training lessons is limited in time, and also that all the changes, caused by complex physical tensions return to the initial level in a day, to solve all the training tasks at each lesson is not appropriate. More effective, is successive alternation of classes with different training orientation tensions. Identifying the structure of weekly microcycle, we were guided by the minimum number of classes per week, which would provide the optimal interval of rest between loads of the same direction that, according to literary sources, does not exceed 48 hours. That is why in order to realize phases of super compensation weekly microcycle should include at least three classes.

The main criterion of the division of training tasks in the predominant direction served as a way of energy securing – phosphate, glycolytic and oxidative. Given the three-time lessons for a week, the optimal variant is complex exercises with the improvement of only two energy systems, each of which varies alternately from class to class (Fig. 3). Training tasks, were solved in the sequence of attracting energy securing ways. Given that exercises for the development of high-speed and power qualities can be provided with energy by the same source, within each of them the training tasks were solved in such sequence: speed – power – endurance. Having provided parallel development of flexibility at each lesson, we received the system of training tasks for a separate training microcycle.

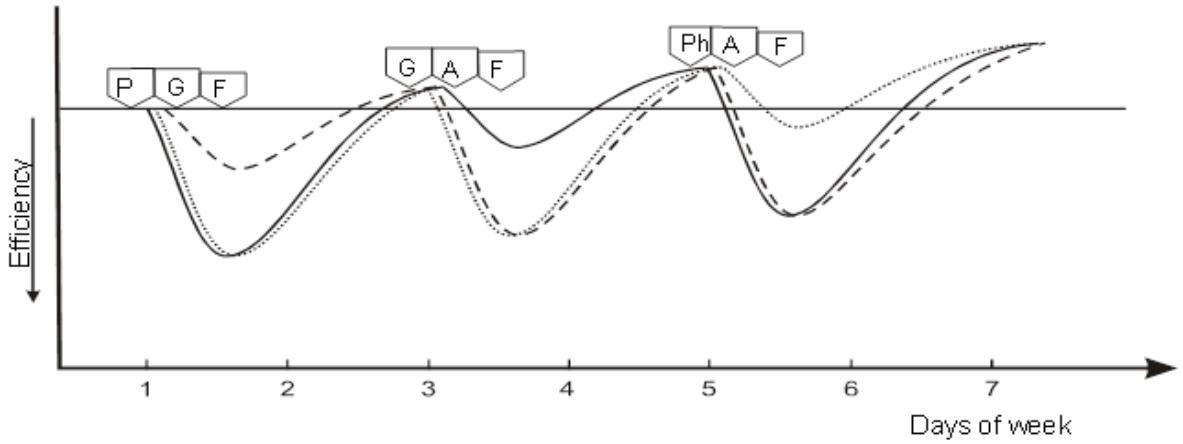

Figure 3. Structure of weekly microcycle of comprehensive development of teenagers physical qualities

Note: Ph – loadings of phosphate direction; G – loadings of glycolytic direction; A – loadings of aerobic direction; F – flexibility

Due to the principle of optimal duration of using training complex one combination of training tasks was used during one training mesocycle (not more than six weeks). After that another combination was used, but at the same time, the continuous stimulation of adaptation processes in all morphofunctional structures of organism has not been lost.

The principle of availability of study material for schoolchildren was laid into the basis of formation of program for study of motor activities. Its realization provided taking into account such conditions of assimilation of motor actions: favorable motor experience; conscious control of non-assimilated elements during doing an exercise; optimal excitability of the central nervous system; appropriate physical preparedness. Favorable motor experience was provided by determining the rational sequence of assimilation of motor actions and rational sequence of doing tasks necessary for the assimilation of each exercise. Conscious control of non-assimilated elements during exercise was provided with concretization of tasks for each lesson.

Based on the dialectical relationship of content and form of physical exercises we have formed the complex system of educational and training tasks for studying motor actions consistent with the comprehensive development of physical qualities, and also have developed the scheme for the selection of adequate means for implementing that system. Formation of system of educational and training tasks consisted in the coordination of training tasks with the training orientation of educational exercises, as well as the technical basis of training motor actions with the technique of educational ones.

The filling of the system of educational and training tasks with additional physical exercises was carried out in such a way that the content of both educational and training motor actions contributed to the comprehensive development of physical qualities, and the form – to effective formulation of motor skills. To ensure the correspondence of the content and form of physical exercises to the set task their selection was carried out by modeling the essence of the motor task in motor actions. It also was taken into account that the development of each motor function was directed at all major muscle groups.

Every training complex was used without changes during assimilation of one motor action. After that, in order to renew training factors, a new training complex was formed.

In the process of constative experiment the level of physical preparedness (due to school complex test and with a help of additional test) and the level of somatic health according to methods [24] have been identified among the eighth grade schoolchildren. Also the thematic evaluation of student achievements was carried out.

To identify the level of physical preparedness we chose test tasks focusing first of all at the determining the functional state of all factors that provide motor activity of a person, with the involvement of the main muscle groups of the body. On the basis of this requirement, the school complex test was added by our additional tests, the content of which expanded the ability to identify the level of perfection of all aspects of physical preparedness of schoolchildren.

At the beginning of the experiment there were no significant differences in indicators of physical preparedness and functional status between control and experimental classes (P>0,05). Qualitative assessment of the level of physical preparedness according to school standards (on a 12-point scale) corresponded to the average level in both groups (4,8 points for boys in CG; 5,3 points for boys in EG; 5,7 – for girls in CG; 5,6 – for girls in EG). The level of somatic health in the examined classes was low.

After the implementation of experimental program the re-testing of teenagers was conducted (Fig. 4). The results of testing physical preparedness indicate a significantly better (P<0,01) increase in the results of children from experimental group in almost all test tasks. The level of physical preparedness of boys from control classes due to the school complex test after finish of the experiment improved by 0,8 points (P>0,05) and remained average (5,6 points), and for boys from experimental classes – by 2,5 points (P<0,001) and became sufficient (7,8 points). For girls from control classes the level of physical preparedness improved by 1,3 points (P>0,05) and from the average moved to the lower limit of sufficient (7 points). For girls from experimental classes evaluation improved by 3,2 points (P<0,001), and the level of physical preparedness moved from the average to the upper limit of sufficient (8,8 points). The average relative increase in physical preparedness (Fig. 4) for boys from control classes was 4,2%, from experimental – 24,3%. For girls from control classes – 13,7%, from experimental – 30,7%.

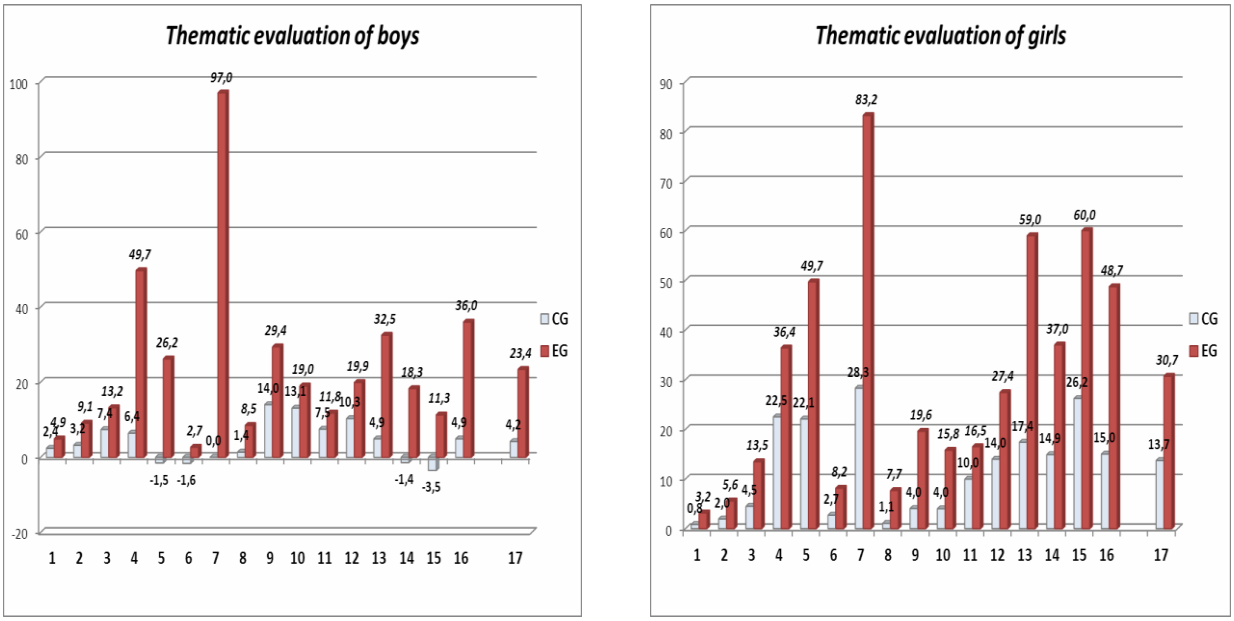

Figure 4. Relative increment of physical preparedness of the examined ones after the experiment

Note:1. Run 4x9 m; 2. Run 60 m; 3. Long jump; 4. Bending and unbending arms in the lying emphasis (push-up); 5. Pull-up on a cross-bar; 6. Run 2000 m; 7. Tilt of the body forward in sitting position; 8. Frequency of hands

movements; 9. Pushing a medical ball 4 kg; 10.Jerk of load 7 kg; 11. Run 400 m; 12. Lifting into sit for 1 min (press); 13. Squats on one leg; 14. Keeping half sitting; 15. Hanging with bent arms; 16. Stretch lying on bended arms; 17. Average rate

Significant shifts (P<0,01) for boys occurred in power indicators, that testifies about the favorable biologic preconditions in age from 13 to 14 years for the improvement of various types of power manifestation. Minor shifts (P>0,05) in the test for identifying the level of development of aerobic endurance indicate at imbalance in the functioning of the organism of teenagers, that confirms the data of literary sources about the need to reduce the amount of physical activities during the development of this quality. However, the reliably better (P<0.05) shifts in experimental classes indicate the need for purposeful development of these qualities for 13-14 years old boys.

The testing results also show the absence of a sensitive period for the development of speed of adolescents in the period from 13 to 14 years. But statistically reliable difference in the final indices between control and experimental classes convinces us in the necessity for purposeful speed development also during the teenage age.

Greater changes in physical preparedness of girls, especially in indicators of different types of endurance, confirm the data that the reciprocal relationships between different systems of 13-14 years old girls' organisms after the critical period become strengthener. This fact indicates that they have better biological preconditions for the full development of physical qualities at this age.

After finishing the experiment pupils of experimental group have got statistically better (P<0,01) indicators of the functional state of organism, that positively affected the level of somatic health.

The general number of points of boys from experimental classes (Tab. 3) after the experiment has grown from one to four points that testifies about the improvement of somatic health from low to lower than average. For the boys of control classes, the total number of points decreased by one point, thus, the level of somatic health remained low.

Table 3. Comparative characteristics of morphofunctional indices of schoolchildren before and after the experiment (CG ♂ = 32; ♀ = 24; EG ♂ = 30; ♀ = 26)

Indicators \ Statistical data			Beginning of experiment				End of experiment				Absolute increment		Relative increment (%)	
			CG		EG		CG		EG		CG	EG	CG	EG
			R	P	R	P	R	P	R	P				
1	Robinson index (c.u.)	♂	97,2	1	101,6	0	114,4	0	101,08	0	-17,2	0,52	-17,7	0,51
		♀	100,1	1	97,6	1	98,15	1	93,5	1	1,95	4,1	1,94	4,2
2	Ruffier index (c.u.)	♂	12,11	-1	13,42	-2	14,77	-2	11,16	-1	-2,66	2,26	-22	16,8
		♀	13,76	-2	14,22	-2	12,21	-1	10,42	2	1,55	3,8	11,3	26,7
3	Life index (ml×kg⁻¹)	♂	58,9	2	58,9	2	59,25	2	63,1	3	0,35	4,2	0,6	7,13
		♀	52,5	2	51,4	2	54	2	55,8	3	1,5	4,4	2,85	8,6
4	Power index (%)	♂	42,9	0	46,4	1	50,5	1	56,2	2	7,6	9,8	17,7	21,1
		♀	38,5	0	35,9	0	40,1	0	46,4	2	1,63	10,5	4,23	29,2
Level of somatic health		♂	low	2	low	1	low	1	lower than	4				

(number of points)	♀	low	1	low	1	low	2	average	8				

Note: R – result; P – points.

There was a slightly different situation among the girls. Thus, in pupils of experimental classes, the level of somatic health has been improved from one to eight points and became average. For girls of control group growing was not so significant (from one till two points), and the level of somatic health has remained low. The positive character of changes in both examined groups submits data of literary sources about favorable biological conditions for purposeful improvement of the cardiovascular system in girls after 13 years. Fewer changes in the level of somatic health of boys compared with girls are predetermined by the age-related functional tension of their cardiovascular system.

Thus, the statistically reliable difference in the indicators of the functional state of organism after the experiment and the qualitative difference in the level of somatic health prove a significantly higher recreational effectiveness of experimental method.

As it is shown at the Figure 5, the experimental educational and training program has shown its efficacy already at the beginning of the experiment during the assimilation of running exercises. Further, both among boys and girls, the difference in points becomes more noticeable. The biggest difference is observed at the end of the school year: the average level of achievements of pupils from the control group was 6,9 points for boys and 6,6 points for girls, what corresponds to the average level of study achievements. Among the boys of experimental group, the average success rate was 8,4 points, among girls – 8,1 points, what corresponds to higher than average level of study achievements.

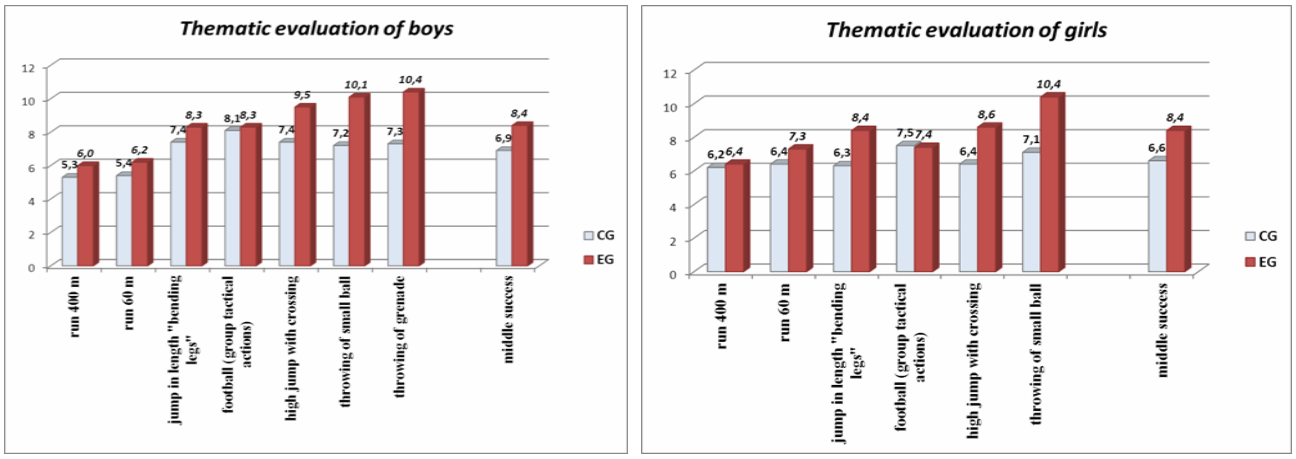

Figure 5. Thematic evaluation of pupils

Such dynamics of motor preparedness in the examined groups is related both with more effectiveness of the experimental program of physical exercises assimilation, and with gradual increasing in the level of physical preparedness of pupils, especially from experimental classes.

4. Discussion

Based on the conducted researches, which consisted in the study of biological regularities of the development

of training and the identification of gaps in modern theories and methods of physical education of adolescents on the basis of them, we have formed the concept of programming of a comprehensive solution of educational and training tasks in the process of physical education of teenagers. Its realization allowed optimizing the process of assimilation of motor actions and comprehensive development of physical qualities in dialectical interaction.

The results of the testing of initial and final level of physical preparedness of 13-14 years old adolescents have confirmed the data of other authors' studies that this age of boys is a sensitive period for the development of speed and maximum power. Among the girls this period is sensitive for the development of anaerobic and aerobic endurance.

The position on expediency of concretization for each class of general educational tasks in the process of assimilation of physical exercises has been confirmed; the position, according to which the development of the principles of the theory of physical education and sports should be based on the theory of organism adaptation to physical tensions.

Analysis of changes in physical preparedness of schoolchildren from EG compared with the schoolchildren from CG confirmed the feasibility of influencing those aspects of motor activities of adolescents for whom the sensitive development period has already passed, or who are in the state of biological delay of development.

The new thing in our research is the development of a scientifically grounded method of formation of educational and training program for the complex solution of tasks of physical education of 13-14 years old teenagers, that provides for the comprehensive development of physical qualities in harmony with the training essence of studying exercises and the selection of adequate means of complex solution of educational and training tasks.

Absolutely new are data about the methods of formation of the program of training tasks for the comprehensive development of physical qualities in the process of physical education of 13-14 years old adolescents. This program provides for the full complex of factors of long-term adaptation to physical tensions.

5. Conclusions

The complex system of educational and training tasks of teenagers' physical education, which was in the basis of the experimental program, includes: subsystem of training tasks of comprehensive development of physical qualities; subsystem of educational tasks; subsystem of adequate means of its realization.

The system of training tasks, directed on comprehensive development of physical qualities, is formed due to such leading principles: correspondence of the direction of physical tensions to the expected direction of adaptation, that according to the carried out by us complex analysis of physical qualities according to the types of their manifestation requires the influence on 16 aspects of motor activity of pupils; continuous stimulation of adaptation processes in all morphofunctional structures of an organism; optimal influence on the specific motor functions of teenagers that is provided by: reducing the number of training tasks while maintaining the comprehensiveness of training effects; small number of training tasks at a separate lesson; optimal sequence of solving tasks; taking into account the optimal effectiveness of the training program (4-6 weeks); implementation of the phase of super compensation from the previous physical tension.

In the basis of formation of the program for studying motor actions lies the principle of matching the educational material with the opportunities of schoolchildren. Its realization provides: proper motor experience of the child; conscious control of unassembled elements during doing exercise, provided by concretization of tasks for each lesson; optimal excitability of the central nervous system, provided by restriction of the amount of educational material at a separate lesson and its study at the beginning of the main part; proper physical preparedness, that is

achieved through the forward-looking purposeful development of physical qualities in the context of their comprehensive development.

Our proposed program has improved the indicators of physical preparedness, functional state and educational achievements of schoolchildren. Thus, the absolute increase of physical qualities of pupils from experimental classes has significantly (P<0,05 – 0,001) exceeded indicators of control classes in most of the test tasks. The general level of physical preparedness of boys from control classes due to the school complex test after the ending of the experiment was improved by 0,8 points and remained at the average level (5,6 points), and boys of experimental classes – increased by 2,5 points and raised to sufficient level (7,8 points). For girls from control classes the level of physical preparedness improved by 1,3 points and from the average moved to the lower limit of sufficient (7 points). For girls from experimental classes, the score improved by 3,2 points, and the level of physical preparedness moved from the average to the upper limit of sufficient (8,8 points).

Relative increase of physical preparedness of boys from control classes was 4,2%, from experimental – 24,3%. In girls of control classes it was 13,7%, of experimental – 30,7%. Greater increase among girls indicates that they have better biological preconditions for the full development of physical qualities from 13 to 14 years.

In schoolchildren from EG during the academic year, statistically significant (R <0,05 – 0,001) changes in all indicators of their morphofunctional state were observed, except for anthropometric in girls, that positively affected the level of somatic health of examined schoolchildren. The total number of points of the boys from experimental classes after the experiment increased from one to four, indicating improvement in the level of somatic health for one qualitative step (from low to lower than average). The level of somatic health of the boys from control classes remained low. The assessment of somatic health of the girls from experimental classes improved from one to eight points and rose to the average level; in girls of control classes – from one to four points, what corresponds to the low level of somatic health.

After ending of the experiment the average level of success of pupils from control classes was 6,9 for boys and 6,6 for girls, what corresponds to the average level of study achievements. For boys of experimental classes it was 8,4 points and 8,1 points for girls, what corresponds to higher than the average level of study achievements.

Conflict of interests

The authors declare that there is no conflict of interest.

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