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Differentiation of the content of classes on physical education, taking into account indicators of physical health and physical preparedness of students in grades 7–9

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Purpose: *to study changes in the physical health indicators of students in grades 7–9 under the influence of a differentiation program for the content of physical education classes.*

Material & Methods: *analysis and generalization of scientific and methodological literature; study of documentary materials and systematization of information; pedagogical observation; biomedical methods; pedagogical testing; methods of mathematical statistics.*

Results: *according to the results of the initial study, the "average" level of physical health of schoolchildren of 7th grades was determined, "below the average" – for students of 8–9th grades and the "low" level of physical preparedness of the studied contingent.*

Conclusions: *the revealed and significant changes (p<0,05–0,001) of indicators of physical health and physical preparedness of students in grades 7–9 of the main groups indicate the effectiveness of the proposed program for differentiating the content of physical education classes.*

Keywords: *differentiation, physical education, physical health, physical preparedness of schoolchildren 13–15 years old.*

Introduction

The health status of the population, especially the younger generation, is one of the factors on which the economic and social progress of our state depends. At the same time, adverse social conditions of life, excessive mental and nervous stress; a decrease in interest in physical education and sports, and sometimes a negative attitude towards them; a sedentary lifestyle leads to a deterioration in the health of the younger generation [12; 24]. So, examining the level of physical health of school-age children (6–18 years old), a number of authors [5; 23] found that 56% of students have a "low" level of physical health, 36% have a "lower than average" level, and only 7,5% "tall". There is no doubt that the fact that the level of physical fitness of children depends on the state of health is also significantly reduced. According to scientific studies, 36.4% of children and adolescents have a "low" level of physical fitness, 33,5% – "below average", 22,6% – "average", 6,7% – "above average" and only 0,8% – "high" [4; 14; 25].

According to leading experts, physical education plays a major role in shaping a healthy generation. However, a number of authors note that the physical education system in educational institutions mainly works ineffectively [16; 24]. Therefore, the issue of finding new, more effective approaches to the organization and content of the educational process in physical education, the introduction of atypical forms of classes in order to educate a healthy and comprehensively developed personality remains relevant.

Modern researchers indicate that this problem can be solved by updating the content of physical education with non-traditional types of motor actions, such as cheerleading [2]; snag golf [8]; health tourism [28] etc.

An analysis of scientific developments on the issue of a differentiated approach in physical education has revealed a significant number of works where the authors prove that defining criteria and distributing students to typological groups makes it possible to adapt the content of physical education in accordance with the individual capabilities of each child and make it more effective [1; 10; 12].

However, it should be noted that the problem of differentiating the content of classes on physical education of middle school students based on the results of monitoring physical health and the level of development of physical qualities is unexplored.

In connection with the above, a timely question is the development and implementation in the educational process of the primary school of a program for differentiating the content of physical education classes taking into account the individual characteristics of students and determining the effectiveness of the proposed innovations on the level of physical health and physical fitness of students in grades 7–9.

Purpose of the study: to investigate changes in indicators of physical health and physical preparedness of students in grades 7–9 under the influence of a program for differentiating the content of physical education classes.

Objectives of the study:

1. To establish the level of physical health and the development of physical qualities of students 13–15 years old.
2. To determine changes in indicators of physical health and physical preparedness of students in grades 7–9 in the process of applying the program for differentiating the content of

physical education classes.

Material and Methods of the research

In order to determine the level of physical health and physical fitness of students in grades 7–9, a stating experiment was conducted, during which the identity of the main and control groups was established (p>0,05). The study involved 226 students in grades 7–9 of comprehensive school No. 150 in Kharkiv, of which 3 main groups (66 men, 79 women) and 3 control groups (41 and 40, respectively) were formed.

During the experiment, the educational process of students in grades 7–9 of the control groups was carried out in accordance with the state program for institutions of general secondary education "Physical Culture. 5–9 grades", the content and its organization were standard.

Based on the analysis of the results of the initial study, a program was developed to differentiate the content of classes in physical education, taking into account indicators of physical health and physical preparedness of students in major groups. The program is built in accordance with the main provisions and includes: goals, objectives, basic methodological principles of training and the structure of the annual cycle of implementation of the program material of the variable component of the state program. The fundamental difference between the experimental program is the differentiation of the content of physical education lessons in accordance with the typological characteristics of students; improving pedagogical methods of organizing the educational process; development of multilevel tasks for each typological group. So, the content of the program material of physical education classes was divided into two levels: basic and variative. The main level contained an invariant component, which was divided into theoretical and methodological knowledge and general physical preparation and a variable component, which included modules: athletics, volleyball, basketball, football.

Based on the differentiation of educational material, taking into account the functional and motor preparedness of schoolchildren of the main groups, we developed the content of the *variable level* and divided it into two sublevels. The 1st sublevel contains exercises aimed at improving functional preparedness. Which included complexes of physical exercises and outdoor games aimed at: improving the regulation of the cardiovascular system and increasing the functional capabilities of the respiratory system. 2nd sublevel – exercises aimed at increasing the level of physical fitness. It includes complexes of physical exercises and outdoor games aimed at increasing the level of development of power and speed abilities and the level of development of coordination abilities and flexibility.

The practical implementation of the proposed program also had some innovations. So, in the *preparatory part*, the tasks of theoretical and general physical preparation were solved. Due to the rational organization of students, increasing the intensity and current performance of general developmental exercises, its duration was reduced to 10 minutes. In the *main part* of the lesson, the tasks of technical and technical-tactical preparation of the planned training variable modules were solved. To solve these problems 10-15 minutes were given. After solving the main problems, students of the main groups were divided into 4 subgroups (A – students with a "low" and "below average" level of regulation of the cardiovascular system B – with a "low" and "below average" level of functionality of the respiratory system, C – with a "low" and "below average" level of strength development and speed abilities, G – students with a "low" and "below average" level of development of coordination abilities and flexibility), received individual task cards and performed specific motor actions specially selected for each formed typological subgroup. In pursuit of the proposed exercises, 10–15 minutes were allotted. In the *final part* of the lesson, the tasks of restoring the body were solved, the results were summed up and a differentiated homework was provided taking into account the individual characteristics of the students. The duration was 3–5 minutes. The implementation of the content of the variable level was carried out according to the periodization of the physical preparation of students [6]. The load changed gradually, in accordance with the age, gender and individual abilities of the students.

During the study, the following methods were used. Theoretical: analysis and synthesis of scientific and methodological literature, the study of documentary materials and the systematization of information. Empirical: pedagogical observation; biomedical methods (to determine the level of physical health of middle school students, the rapid assessment method proposed by S. D. Polyakov et al. was used) pedagogical testing; pedagogical experiment. Methods of mathematical statistics.

Results of the research

The level of physical health of students aged 13–15 was determined by indicators of the Quetelet 2, Robinson, Skibinsky, Shapovalova and Rufie indices. The data analysis revealed the "average" level of physical health in 13-year-old students of both study groups and 14-year-old boys in the control group. "Below the average" level was set in schoolchildren of 15 years of both studied groups, students of 14 years of basic groups and girls of 14 years of control groups.

The level of physical preparedness of students was determined by indicators of the development of basic physical qualities. For this, motor tests proposed by L. P. Sergienko were used [17; 18] and V. A. Romanenko [19]. Thus, the results of the initial study indicate a "low" level of physical preparedness for students in grades 7–9 (speed abilities – 2 points, coordination abilities, strength, flexibility and endurance – 1 point, respectively).

Analyzing the data obtained after the pedagogical experiment, it was determined that in indicators reflecting the level of physical health, both children and girls of the main groups experienced significant positive changes in all the studied parameters (p<0,05–0,001). Thus, indicators of the body length of the children of the main groups varied from 1571,11 to 1748,95 cm, for women – from 1562,73 to 1661,30 cm; body weight in men ranged from 46,78 to 59,58 kg, in women from 45,73 to 50,61; blood pressure (BP) values in children ranged from 102,34/68,06 to 109,37/71,05 mmHg, for girls – from 101,55/66,42 to 106,30/70,13 mmHg; heart rate data (HR) in children ranged from 75,17 to 76,79 beats·min^{-1}, for girls – from 76,15 to 76,48 beats·min^{-1}; the results of vital lung capacity (VC) in children ranged from 2472,22 to 3278,95 ml, in girls – from 2300,00 to 2760,87 ml; indicators of breath holding time (Stange test) in children ranged from 41,21 to

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44,32 s, in girls – from 39,97 to 44,04 s; the results of lifting the torso in the grades in children varied from 32,58 to 46,67 times, in girls – from 29,57 to 42,70 times; heart rates at rest (P_1) for children ranged from 16,33 to 19,47 beats, for girls – from 16,55 to 17.26 beats; Heart rate in the first 15 from the first minute of recovery (P_2) for children ranged from 29.94 to 33,76 beats, for girls – from 30,00 to 32,43 beats; heart rate data for the last 15 from the first minute of recovery (P_3) for children ranged from 18,28 to 21,74 strokes, for girls – from 18.79 to 19,61 strokes.

As a result of the above, the level of physical health in children of 7th grade increased from "middle" to "above average", in students of 8–9th grade from "below average" to "average". The exception is indicators of girls of 7th grades, where the increase in the total points in five indices from 14 to 17 points on the level scale was not reflected (Figure 1).

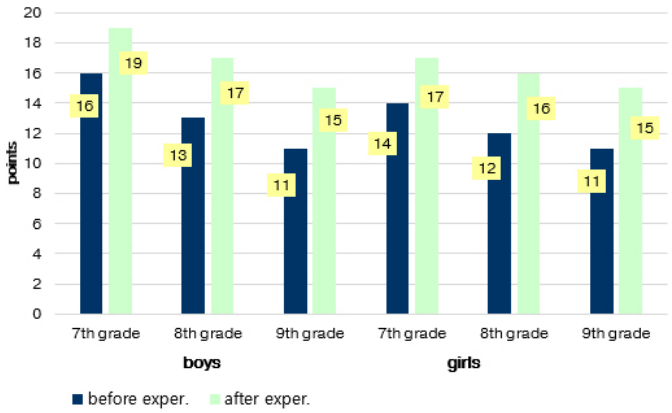

Fig. 1. Indicators of the general level of physical health of students of the main groups before and after the experiment

The most significantly improved indicators of the regulation of the cardiovascular system of students 13–15 years old (from "below average" to "average") and the respiratory system of children 15 years old and girls 13–14 years old (from "low" to "average" level).

In schoolchildren of control groups after the experiment, significant changes were not determined. The exception is indicators of length and body weight, where the changes are significant ($p<0.05–0.001$) of the specific intensity of the work performed by children of 9th grade, where the level increased from "low" to "below average"; regulation of the cardiovascular system of girls of 8th grade, where the level from "below average" increased to "middle" and guys of 9th grade, where, on the contrary, the level decreased from "average" to "below average". However, these changes at the level of physical health of schoolchildren in control groups did not significantly affect and he remained at the primary "below average" level.

An analysis of the results of the development of physical qualities obtained after the implementation of the developed program indicates positive changes in all parameters that were studied ($p <0,05–0,001$) (Table 1).

Thus, the growth rate of the development of speed abilities on average ranged from 2% to 17% in men and from 1% to 15% in girls; coordination abilities – from 3% to 118% and from 6% to 103%, respectively; strenght abilities – from 16,7% to 42,11% and from 16,52% to 28,95%, respectively; flexibility – from 2% to 26% and from 4% to 33%, respectively; endurance – from 16% to 59% in men and from 22% to 39% in girls.

The indicators of strength development of students aged 14–15 years improved more significantly (31,8% and 30,5%, respectively); flexibility and speed abilities – schoolchildren of

Table 1

Indicators of the level of development of physical qualities of schoolchildren of the main groups before and after the experiment, $\bar{X}\pm m$

Grades	7 grade		8 grade		9 grade	
n	(n=18)	(n=33)	(n=29)	(n=23)	(n=19)	(n=23)
sex	boys	girls	boys	girls	boys	girls
Speed abilities						
"Handover" test (cm)						
Before exper.	21,22±2,16	20,39±1,34	20,03±1,09	21,48±1,99	19,05±1,07	15,54±1,38
After exper.	16,44±0,66	17,15±0,79	16,00±0,65	16,13±0,91	15,47±0,45	11,35±1,01
t	2,68	4,10	7,31	4,08	5,00	4,35
p	<0,05	<0,001	<0,001	<0,001	<0,001	<0,001
Tapping test for 10 s (number of movements)						
Before exper.	35,83±1,58	31,58±0,83	36,69±1,50	35,65±1,24	31,26±1,27	29,48±0,93
After exper.	40,22±1,64	36,36±0,88	40,28±1,28	38,96±1,13	38,32±1,19	33,65±0,96
t	9,16	7,70	9,21	9,52	8,65	19,88
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Running on 60 m (s)						
Before exper.	10,24±0,16	10,77±0,15	10,34±0,15	10,84±0,20	9,75±0,11	10,71±0,13
After exper.	10,11±0,14	10,66±0,14	10,19±0,14	10,73±0,20	9,41±0,11	10,43±0,11
t	5,66	6,19	10,09	8,65	10,45	7,74
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Coordination abilities						
Rhythmic hand tapping (number of cycles)						
Before exper.	7,50±0,52	7,18±0,37	7,59±0,34	8,13±0,66	7,63±0,53	7,74±0,46
After exper.	10,28±0,44	10,85±0,36	10,79±0,32	12,30±0,45	10,53±0,51	11,09±0,42

continuation table 1

t	9,42	10,90	15,50	9,61	27,50	21,18
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Ten "Eights" (Kopylov test) (s)						
Before exper.	14,69±0,97	14,15±0,43	15,55±0,49	14,39±0,30	13,58±0,61	12,74±0,73
After exper.	13,24±0,77	13,34±0,54	13,74±0,37	13,19±0,23	12,13±0,41	11,37±0,41
t	3,63	2,15	11,37	9,59	5,85	3,07
p	<0,01	<0,05	<0,001	<0,001	<0,001	<0,01
Static equilibrium by the Bondarevsky method (s)						
Before exper.	44,78±3,22	43,33±1,71	48,31±1,73	48,09±1,80	43,05±1,36	48,87±3,00
After exper.	57,33±1,68	54,97±1,36	56,17±1,19	57,83±0,83	51,16±0,77	56,57±2,13
t	4,83	11,84	11,35	7,72	8,92	8,14
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Throws small ball in the goal (points)						
Before exper.	4,17±0,28	4,15±0,29	2,97±0,23	2,74±0,38	4,42±0,44	4,96±0,28
After exper.	7,00±0,36	6,52±0,25	5,83±0,16	6,26±0,25	6,05±0,42	7,09±0,26
t	10,63	10,68	19,52	10,08	4,52	12,02
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Throwing a small ball at a distance (m)						
Before exper.	15,77±0,09	8,51±0,06	18,90±0,33	8,78±0,08	23,83±0,23	9,41±0,06
After exper.	16,33±0,08	9,00±0,06	19,39±0,24	9,23±0,06	24,66±0,17	10,25±0,12
t	10,51	16,06	5,33	12,50	9,15	9,99
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Strength abilities						
Bending and extending the arms in resting position (number of times)						
Before exper.	19,33±1,08	12,39±0,50	17,66±1,10	10,70±0,72	23,26±1,10	8,70±0,35
After exper.	24,06±0,54	14,00±0,41	24,52±0,46	13,26±0,52	26,42±0,99	12,09±0,29
t	5,62	9,54	7,29	8,35	10,93	19,82
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Three jumps on one foot with forward movement (m)						
Before exper.	4,39±0,12	3,78±0,07	3,94±0,14	3,68±0,15	3,89±0,16	3,71±0,08
After exper.	4,89±0,13	4,33±0,07	4,74±0,10	4,38±0,09	5,08±0,13	4,62±0,09
t	10,90	11,51	14,13	9,58	10,53	15,67
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Lifting the trunk in the saddle (number of times)						
Before exper.	44,56±0,63	41,33±0,57	36,86±1,76	34,57±0,66	28,16±1,22	25,91±0,81
After exper.	46,67±0,29	42,70±0,49	41,76±1,16	38,70±1,15	32,58±1,22	39,04±1,10
t	4,35	9,11	4,87	3,28	15,84	11,78
p	<0,001	<0,001	<0,001	<0,01	<0,001	<0,001
Flexibility						
Tilt forward torso from sitting position (cm)						
Before exper.	3,83±0,71	8,21±0,93	1,79±0,33	10,87±1,56	4,37±0,66	11,04±1,72
After exper.	4,33±0,74	9,48±0,78	2,62±0,30	11,61±1,47	5,79±0,64	12,39±1,63
t	2,62	5,14	8,26	4,71	10,20	7,94
p	<0,05	<0,001	<0,001	<0,001	<0,001	<0,001
Straightening of straight arms back and forth (cm)						
Before exper.	80,44±3,55	83,67±2,38	96,41±0,81	75,78±4,19	96,89±2,28	83,26±3,86
After exper.	79,33±3,64	81,58±2,43	94,93±0,79	71,22±4,09	93,58±2,20	79,70±3,91
t	5,08	3,81	13,89	4,40	11,17	16,19
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Cross twine (cm)						
Before exper.	38,61±2,17	28,97±2,00	45,62±0,89	28,00±2,31	42,53±2,40	28,91±2,53
After exper.	35,83±2,25	27,30±2,02	44,28±0,88	25,91±2,37	40,37±2,36	26,39±2,48
t	3,13	11,21	11,79	4,65	8,40	5,09
p	<0,01	<0,001	<0,001	<0,001	<0,001	<0,001
Endurance						
Deflection bending (number of times)						
Before exper.	11,67±0,47	12,85±0,85	20,14±1,14	14,87±0,83	19,79±0,64	19,65±1,43
After exper.	18,06±1,15	17,30±0,98	22,90±1,04	17,83±0,74	24,79±0,80	23,48±1,25
t	5,42	6,24	10,20	12,80	15,41	12,28
p	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001

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15 years old (17,7% and 12,5%, respectively); stamina – students 13 years old (49,5%); coordination abilities – schoolchildren of 14 years old (50,0%).

As a result, the level of development of the physical qualities of students in the main groups increased on average by 1,4 points and began to meet the assessment of 2,4 points (Figure 2).

As a result, the level of physical preparedness of students in the main groups from "low" increased to "below average".

The analysis of the data obtained by schoolchildren in control groups did not reveal significant changes in the indicators of manifestation of physical qualities and, as a result, their level of physical fitness did not change ("low" level).

From the noted it can be concluded that the introduction of an experimental program for differentiating the content of physical education classes has a positive effect on the level of physical health and physical fitness of students in grades 7–9 of the main groups.

Conclusions / Discussion

The analysis of the results of the study showed, basically, a significant increase in weight and height indicators of students of all studied groups (p<0.05-0.001), which is consistent with the data of several authors [9; 22; 27], according to which adolescence is characterized by an intensive increase in body size, mainly due to lengthening of the legs, torso growth, and an increase in total muscle mass, which, in our opinion, confirms the purely natural nature of the changes in the anthropometric indices of schoolchildren aged 13–15.

The analysis of indicators reflecting the functional state of the cardiovascular and respiratory systems suggests that, after the introduction of exercises aimed at increasing functional preparedness, a tendency to a decrease in blood pressure and heart rate and an increase in lung capacity and time were revealed. breath holding in schoolchildren 13–15 years old of the main groups (p<0,01, 0,001). The data obtained are confirmed by a number of studies, during which it was established an improvement in the functionality of the cardiorespiratory system under the influence of cheerleading [2; 20]; aerobics

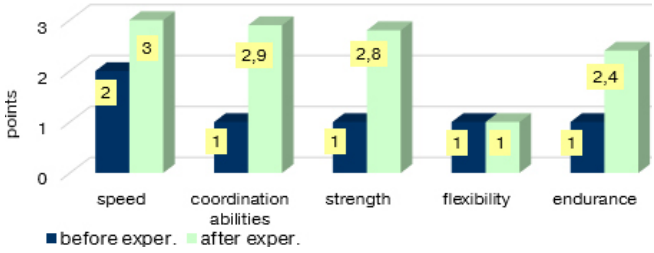

Fig. 2. Average estimates of the development of physical qualities of students in grades 7–9 of the main groups before and after the experiment

of power orientation [15]; rugby 5 [21]; sports tourism [28], a system of physical exercises for differentiated training [10].

An analysis of the results characterizing the level of physical preparedness obtained after the pedagogical experiment revealed a significant increase in indicators for both children and girls of the main groups, for all the studied parameters (p<0,05–0,001). In our opinion, the positive changes are explained by the fact that the content of the variable level of the proposed experimental program was developed on the basis of differentiation of educational material taking into account the individual capabilities of students and supplemented with physical exercises and modified outdoor games aimed at developing physical qualities.

The results obtained are consistent with the data of several authors [3; 7] on the effectiveness of the impact of various types of motor activity on the physical preparedness of adolescent children; the effectiveness of differentiation of educational material, taking into account the level of individual motor abilities of students aged 13–15 [11; 13].

Thus, our studies indicate the positive impact of our proposed program to differentiate the content of physical education classes on the level of physical health and physical fitness of students in grades 7–9 of the primary school.

Prospects for further research in this direction include the introduction of a program for differentiating the content of training sessions in the process of physical education of another age group.

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