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Impact of physical education and recreational activities with elements of roller skating on the morphofunctional state of schoolchildren in grades 5–6

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Purpose: *to determine the impact of fitness classes with the priority use of roller skating on the morphofunctional state and physical fitness of schoolchildren in grades 5–6.*

Material & Methods: *194 children of 10–12 years old took part in the experiment, 90 of them were boys and 104 girls. The study was conducted on the basis of school number 269, Kiev with in-depth study of the French language. In the process of research, the following methods were applied: pedagogical (pedagogical experiment and observation); anthropometric; physiological (pulsometry, spirometry, functional tests) methods of mathematical statistics.*

Results: *study shows that among pupils in grades 5–6, physical culture and fitness classes with priority use of roller skating means because positive changes in the morphofunctional state and physical fitness. Significant improvements were found after 9 months of regular classes.*

Conclusion: *fitness classes with the priority use of roller skating means have a positive effect on the morphofunctional state and physical fitness of schoolchildren in grades 5–6. It was revealed that the indicators of the functional state (in particular, the cardiovascular and respiratory systems), physical fitness of schoolchildre compared with the initial data are significantly higher ($P(t)<0,01$; $P(t)<0,001$).*

Keywords: *fitness and fitness classes, roller skating, schoolchildren of 5–6 grades.*

Introduction

In the conditions of the development of the national system of general secondary education, the innovative activity of general educational institutions, which is characterized by systemic experimentation, testing and application of innovations (innovations) in the educational process, is of great importance.

In connection with the deterioration of health and a decrease in the level of physical preparedness of schoolchildren, the search for new ways to improve them in the process of physical education is being actively pursued. The introduction of innovative technologies in the field of physical education is the subject of research by many scientists (V. A. Kashuba, 2016; N. V. Moskalenko, 2011; N. E. Pangelova, V. Yu. Ruban, 2015) [1; 3; 5].

A. N. Sainchuk [6] in his work "Programming physical education and health activities Scandinavian walking in physical education of younger schoolchildren" notes that the low efficiency of the school system of physical culture is associated with the lack of sustainable motivational attitudes on physical activity, outdated approaches and means of organization and constructing both lesson and extracurricular forms of employment. Modernity requires a reorientation of teachers of physical training in the application of innovative health and fitness technologies in physical training of studying youth, where the structure of employment would have been closer to the type of sports training, based on the scientific achievements of sports and sports industry and definitely would have been determined in perspective, that is, program-controlled.

T. G. Kozhedub [2] proposed an innovative technology for theoretical training of schoolchildren, which made it possible to improve the indices of physical activity, the level of physical preparedness, physical development and the state of health of schoolchildren, which makes it advisable to use it in the system of physical education for children of middle school age.

T. G. Omelchenko [4] substantiated the model of the pre-anozological condition of the organism of junior schoolchildren (not counting anthropometric, physiological (cardiovascular), psychophysiological indicators, coefficient of physical development and mental state of the organism), and on the basis of it developed the technology of control and correction of the pre-organism state of the organism on an example of physical education and fitness classes with elements of fitball-aerobics.

But the introduction of innovative technologies in the process of school physical education remains limited, which actualizes the scientific search in this direction.

The proposed innovative approach is the organization of extra-curricular activities with the priority use of roller skating means. High emotionality, effective development of aerobic abilities determine the great popularity of roller skating and determine this type of motor activity as one of the most common. Nowadays around 15 million people are engaged in roller skating [8; 11].

The physiological value of this type of motor activity is a posi-

tive effect on the cardiovascular, respiratory, musculoskeletal and muscular systems. As a result of performing specific movements that require constant monitoring of balance and balancing, the work of the vestibular apparatus is improved, as well as coordination abilities. This releases the hormone endorphin (the hormone of "happiness"), which contributes to elevated mood [9; 12].

Roller skating is especially important for schoolchildren who are overweight. So, for an hour of skiing at a uniform pace of medium intensity, it is possible to lose 400 kcal, and intensive skating with acceleration "burns" 900 kcal. In addition, in the process of such studies, the metabolism is normalized.

Simple skating is possible to diversify with active games. Practically any sports games can be adapted for game activity. The most attractive of them, which correspond to the specifics of movement on roller skates, are dynamic and mobile games, the holding of which does not require a large area size. Unlike sports, roller skating does not require a specially equipped playground or sports equipment [10; 13].

Biomechanical features of roller skating allow you to include in the work of such muscle groups that are difficult to develop with the help of other exercises. The effectiveness of classes is largely determined by the technical equipment: roller skates, special clothing, a helmet, knee pads and elbow pads [7].

It has been established that the age of 10–12 years is favorable for the improvement of aerobic abilities, therefore the development of physical-health programs for this type takes on exceptional importance. Skating on roller skates is an effective means of recovery, uses a large number of muscles, while not going beyond the limits of the aerobic energy supply mode.

Purpose of the study: to determine the impact of physical education and health-improving classes with the priority use of roller skating on morphofunctional state and physical fitness of schoolchildren in 5–6 grades.

Material and Methods of the research

The experiment involved 194 children, 10–12 years of age, of which 90 boys and 104 girls. The study was conducted on the basis of school number 269, Kiev. With in-depth study of the French language.

In each age group, control and experimental groups were created. The control group consisted of 97 schoolchildren, and in the experimental – 99.

Pupils who entered the experimental groups regularly attended extracurricular activities 2–3 times a week with elements of roller skating. Duration of one lesson is 60–70 minutes. In the course of the study, testing was conducted to determine the morphofunctional state, physical fitness and health status of schoolchildren in grades 5–6 at the beginning of the experiment and at the end (in September 2017, initial indicators were recorded; in May 2018, indicators were recorded after 9 months of practice with roller skates).

The program "Roller Skates: Innovative Vector in Education" was developed, the content of which included both traditional means of physical education and innovative using skating means on roller skates, was experimentally tested in the process of extracurricular organizational forms of physical education (Figure 1).

The proposed innovative program does not replace and does not exclude the generally accepted organizational forms of physical exercises in the secondary school. We are talking about the inclusion in the physical culture and health of the elements of innovative technologies that enhance the physical condition of the student and were interpreted by us in accordance with the goals and objectives of the study.

In the process of research, the following methods were applied: pedagogical (pedagogical experiment and observation); anthropometric; physiological (pulsometry, spirometry, functional tests) methods of mathematical statistics.

Table 1

Indicators of the morphofunctional state of schoolchildren in 5 grades of the control and experimental groups

Indicators	Before experiment				After experiment											
	general (n=97)				control (n=47)				experimental (n=50)				girls		boys	
	girls (n=51)		boys (n=46)		girls (n=25)		boys (n=22)		girls (n=26)		boys (n=24)					
	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	t	p	t	p
Body length, cm	143.7	0.88	140.1	0.83	147.2	1.31	144.2	1.3	148	0.98	144.1	0.89	0.5	>0.05	0.06	>0.05
Body weight, kg	35.4	0.67	34.3	0.73	37.9	0.9	38.1	1.14	37.2	0.87	37.5	0.83	0.56	>0.05	0.42	>0.05
Circumference of the chest, cm	69.1	0.64	67.8	1.46	70.1	0.75	71.1	1	70.5	0.97	70.6	0.85	0.32	>0.05	0.38	>0.05
HR present rest, beats. min^{-1}	76	0.9	76.1	1.1	73	1.18	72	1.58	69	0.83	68	1.12	2.78	**<0.05**	2.06	**<0.05**
VC, ml	1782.6	27.98	1763.5	30.67	1852	37.35	1844.1	44.98	1953	24.74	1950.42	26	2.25	**<0.05**	2.03	**<0.05**
Sample Stange, s	28.5	0.65	32.3	0.84	29.7	1.12	32.8	1.06	36.4	1.31	36.9	1.18	3.9	**<0.05**	2.59	**<0.05**
Gench test, s	15.7	0.4	18.5	0.57	17.1	0.37	19.8	0.7	20	0.79	23.9	1.2	3.33	**<0.05**	2.97	**<0.05**
Index Rufie, points	18.3	0.56	6.8	0.53	7.2	0.35	6.7	0.4	5.8	0.26	5.4	0.3	3.86	**<0.05**	2.6	**<0.05**
Robinson index, condition units	87.2	1	88.24	1.25	88.16	1.29	86.36	1.89	83.65	1.12	83.58	1.56	2.65	**<0.05**	1.13	>0.05

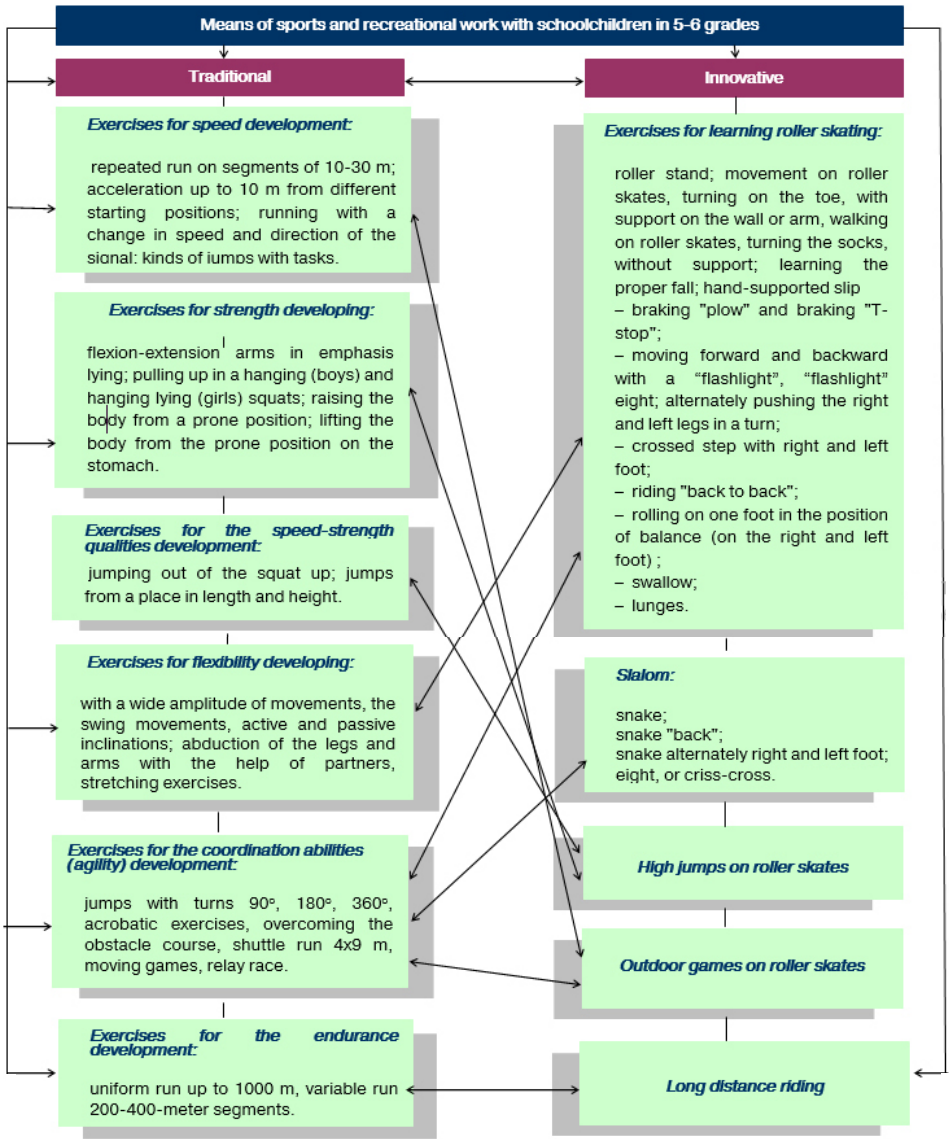

Figure 1. Content of the program "Roller Skates: Innovative Vector in Education"

Results of the research

In order to test the effectiveness of introducing innovative technology into the process of physical education of schoolchildren of grades 5–6, we conducted a comparative analysis of indicators of morphofunctional state, physical fitness and state of health of schoolchildren, obtained after the main stage of the pedagogical experiment (May 2018).

In the process of analyzing the results of the molding pedagogical experiment, it was revealed that such indicators of physical development as length, body weight, chest circumference in pupils of 5–6 grades, both the control and experimental groups were approximately the same.

With regard to the functional capabilities of the studied groups, it can be noted that in the experimental groups of schoolchildren in grades 5–6, both in boys and girls, spirometry, pulsometry, Rufier, Stange, Genchi, Robinson index were higher (except for Robinson in grade 5 children) with a significant difference with the control groups ($p<0,05$) (Tables 1, 2).

This allows us to conclude that an innovative program with the use of rollerblading means has been positively influenced to improve the adaptation mechanisms of the body of schoolchildren in grades 5–6 to physical exertion.

Physical training of schoolchildren of 5–6 classes after completion of pedagogical experiment was determined by the following test: run 30 meters, running 1,000 meters, shuttle 4x9 m run, standing long jump, pulling up, flexion-extension arms in emphasis lying, leaning forward from sitting.

The calculation of the Student's t-test allows us to speak about the significant advantage of the children of the experimental groups over their peers in terms of physical fitness. This is clearly seen among schoolchildren in grades 5–6 in terms of speed-strength abilities, endurance, muscle strength of the arms, flexibility and coordination abilities (Figure 2, 3).

Analyzing the results of studies of physical preparedness of schoolchildren in grades 5–6, it should be noted that all indicators showed positive changes in the experimental and control groups, both in girls and boys, but with different rates of their growth.

The largest percentage growth rates observed in the tests "pull-ups" and "flexion-extension arms in emphasis lying", characterizing the level of development of the strength of the

Table 2

Indicators of the morphofunctional state of schoolchildren in 6 grades of the control and experimental groups

Indicators	Before experiment				After experiment											
	general (n=97)				control (n=45)				experimental (n=52)				girls		boys	
	girls (n=51)		boys (n=46)		girls (n=25)		boys (n=20)		girls (n=28)		boys (n=24)					
	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	t	p	t	p
Body length, cm	150.3	0.96	148.8	1.14	153.3	1.27	152.1	1.43	154.4	1.44	153.4	1.66	0.57	>0.05	0.59	>0.05
Body weight, kg	40.6	0.93	40.3	1.03	43.3	1.21	43.4	1.3	41.9	1.13	44.3	1.39	0.88	>0.05	0.47	>0.05
Circumference of the chest, cm	72.2	0.59	73	0.69	74.3	0.74	75.2	0.96	73.3	0.93	75	0.97	0.84	>0.05	0.15	>0.05
HR present rest, beats·min^{-1}	70.3	0.81	71.2	0.84	69.1	0.92	66.6	1.56	65.8	0.61	62.25	1.29	2.67	**<0.05**	2.15	**<0.05**
VC, ml	1899	24.27	2063	29.2	1945	32.21	2092	41.98	2044	28.6	2202	24.8	2.31	**<0.05**	2.25	**<0.05**
Sample Stange, s	33.2	0.85	40.1	1.1	35.5	0.92	42	1.6	39.4	1.28	46.58	1.3	2.46	**<0.05**	2.22	**<0.05**
Gench test, s	17.8	0.5	21.2	0.56	19.2	0.62	22.8	0.66	21.7	0.57	26.58	0.7	2.98	**<0.05**	3.9	**<0.05**
Index Rufie, points	8	0.62	6.2	0.5	6.9	0.34	5.7	0.4	5.3	0.23	4.5	0.2	3.9	**<0.05**	2.72	**<0.05**
Robinson index, condition units	84.15	0.94	83.11	1	83.6	1.07	81.7	1.36	80.25	0.9	77	1.32	2.41	**<0.05**	3.91	**<0.05**

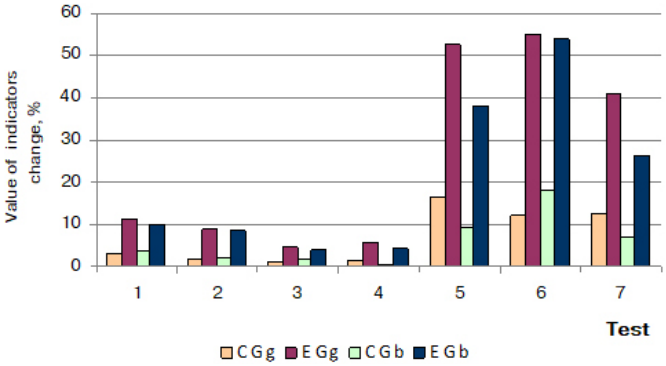

Figure 2. Changes in physical preparedness indicators of girls and boys of the 5th grade of the studied groups after the experiment:
1 – running 30 m; 2 – 1,000 m 3 – shuttle run 4x9 m; 4 –standing long jump; 5 – flexion-extension arms in emphasis lying; 6 – pulling up; 7 – torso forward from the sitting position. CGg – control group, girls; EGg – experimental group, girls; CGb – control group boys; EGb – experimental group, boys.

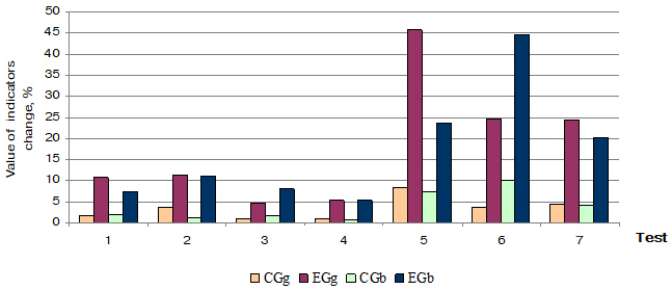

Figure 3. Changes in physical preparedness indicators of girls and boys of the 6th grade of the studied groups after the experiment:
1 – running 30 m; 2 – 1,000 m 3 – shuttle run 4x9 m; 4 –standing long jump; 5 – flexion-extension arms in emphasis lying; 6 – pulling up; 7 – torso forward from the sitting position. CGg – control group, girls; EGg – experimental group, girls; CGb – control group boys; EGb – experimental group, boys.

arm muscles. This ability develops most intensively in children 10–12 years old. In the experimental groups in the "pull-up" test, we obtained the following results: for girls in the 5th grade – 54,9%, and for men – 44%. In the control groups, there was also a high growth rate – among girls of the 5th grade – 11,9%, among boys – 18,2%; for schoolchildren in grade 6th 3,6% and 10,2%, respectively. In the experimental groups in the test "flexion-extension arms in emphasis lying" such an increase in indicators: among girls of the 5th class – 52,6%, among boys – 38,1%; among pupils of the 6th grade – 45,7% and 23,6%, respectively. In the control groups, there were also improvements in the results: for girls in the 5th grade, 16.4%, for men – 9,3%; in sixth-graders – girls – 9,3%, boys 7,3%, respectively.

We also note the high growth rates in the indices of the "torso-leaning in the sitting position" test, which characterizes flexibility in pupils of experimental groups (grade 5 – girls – 40,9%, guys – 26,1%, grade 6 – girls – 24,.2%, children – 20,2%) and in the control groups – for pupils of 5 classes – 12,3% and 7,2%; Grade 6 – 4,5% and 4,2% respectively.

Indicators of the "standing long jump" test, characterizing speed-strength abilities, also increased. You can talk about positive dynamics in schoolchildren of both the 5th and 6th grades: 5th grade – girls – 5,6%, guys – 4,3%; Grade 6 – 5,1% and 5,3% respectively.

It is necessary to note the improvement in motor test results, which characterize the level of speed and coordination abilities, as well as endurance in schoolchildren of experimental groups, both in girls and in boys (running 30 m – girls – 10,7–11,2%, guys – 10–10,7%, "shuttle" running 4x9 m – girls – 4,7%, boys – 3,8–8%; running 1000 m – 8,9–11,3% and 8,5–10,9% respectively).

The obtained results testify to the positive influence of the innovation program "Roller skates: an innovative method in

physical education" on the physical preparedness of schoolchildren 5–6 classes.

Conclusions / Discussion

As a result of a formative experiment conducted during 9 months, it can be stated that fitness classes with priority use of riding on roller skates means have a positive effect on the morphofunctional state and physical preparedness of schoolchildren in grades 5–6. It was revealed that the indicators of the functional state (in particular, the cardiovascular and respiratory systems), physical fitness in comparison with the initial data are significantly high ($P(t) < 0,01$; $P(t) < 0,001$). Thus, rationally constructed lessons on the priority use of rollerblading means contribute to the improvement of the functioning of organs and systems, and therefore – the functioning of schoolchildren as a whole.

The prospect of further research is to develop organizational and methodical bases of use of means of riding on roller skates in the system of physical education of high school schoolchildren.

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