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Research Paper

A Study of the Effect of Chinese Wushu Exercises on the Physical Fitness of 10-11years Old Children in China

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Abstract. *The introduction of specific national martial arts in the educational program of physical education of schoolchildren in the PRC contributes to the optimization of the learning process, and, as a consequence, the improvement of physical fitness. The article presents the results of a comparative study of the dynamics of physical fitness of 10-11 years old students using traditional methods of physical education and experimental methods using Wushu. It is determined that the method proposed by the authors, based on Wushu exercises, contributes to the effective development of coordination and strength abilities, speed, endurance and flexibility in students of this age category. A variety of basic Wushu exercises, including taolu elements, reveal the physical potential of children and contribute to their overall physical and cultural development.*
Keywords: *wushu, wushu sports, children's physical fitness*.

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I. Introduction

Physical fitness of people plays a crucial role in creating an efficient and innovative labor force, which is the basis for the progress of any society. Labor, as one of the key productive forces of mankind, is the most important factor of production [1]. At the same time, the quality and qualification level of workers directly determine the efficiency of economic development and competitiveness of the nation. Investments in education and physical culture contribute not only to improving the professional level of workers, but also become a driving force of modernization of modern life, which, in turn, leads to sustainable social progress and improvement of the quality of life in general. [2, P. 11-12]. Good physical fitness is not just a guarantee of a strong body, but also a powerful stimulus for mental activity, revealing inner talents and abilities. It is talents, in turn, that become the foundation of the nation's competitiveness, the driving force of its transformation and progress [3; 4, P. 4]. The physical health of adolescents plays a special role in this process, because they are the embodiment of the future of the country. Not only the well-being of the state, but also the prosperity of society, the happiness of each family and the personal success of an individual depends on the level of their physical fitness [5, P. 1-2]. Thus, care about the physical development of the young generation is a contribution to the sustainable development of the nation, its strength and harmony.

In accordance with the "National Standards of Physical Fitness and Health of Students" and based on an in-depth analysis of scientific literature, a study was conducted with the participation of 140 schoolchildren. The participants were divided into experimental and control groups. All of them underwent a comprehensive test approved by the Ministry of Education of the People's Republic of China, including such parameters as body length and weight, lung vital capacity (LVVC), 50-meter run, forward bends from a sitting position, one-minute squats, one-minute jump rope, and 8 × 50-meter run. The pre-test results met the requirements of the "National Standards" [6].

Improvement of physical condition, associated with the development of physical fitness, ultimately contributes to a more complete satisfaction of the needs for self-improvement and self-actualization. This process is conscious, proactive and purposeful [7, P. 1-2].

The purpose of this study was to develop and approbation of a method based on Wushu exercises, aimed at the effective development of coordination and strength abilities, speed, endurance and flexibility in students 10-11 years old.

II. Method and materials

The study aimed at improving the effectiveness of training in junior schoolchildren using topical

methods was based on a comprehensive approach that harmoniously combines both theoretical and empirical research to achieve the objectives of the study. The theoretical basis of the study was based on the analysis of scientific literature covering both classical pedagogical concepts and modern approaches to physical education, with a special emphasis on the development of physical qualities and the formation of physical condition through the prism of traditional martial arts, close to Chinese children in spirit and mentality. The study of literature sources allowed us to identify the key problems in the field of physical education of schoolchildren, among which are insufficient motivation of students and lack of practical orientation in training.

The empirical part of the study was embodied in the form of a formative experiment, which lasted nine months - from January to September. The experiment involved 140 schoolchildren aged 10-11, divided into experimental (EG) and control groups (CG) of 35 boys and 35 girls in each group. As part of the study, the participants attended optional wushu classes twice a week, on Mondays and Thursdays, thus supplementing standard physical education classes. This unique experience not only improved the children's physical fitness, but also created a favorable environment for the development of physical qualities.

Each training session lasted from 80 to 95 minutes and included the following stages:
5-10 minutes - basic warm-up and preparatory exercises;
35-40 minutes - basic wushu training;
35-40 minutes - specialized wushu training;
5 minutes - final part: summarizing and collecting materials.

In CG optional classes were built in accordance with the standards of the school physical education program. Both EG and CG participants followed their training programs throughout the study period.

The following theoretical and experimental research methods were used to solve the set tasks: study, analysis and generalization of literature data, pedagogical observations, control and pedagogical tests provided by the Ministry of Education of the People's Republic of China, pedagogical forming experiment, mathematical and statistical data processing.

In order to realize the purpose of the study, a methodology based on Wushu exercises was developed and, solving the problem of effective improvement of students' physical fitness. A distinctive element of the method was the introduction of a competitive link at all stages, increasing the motivation of children.

The main principles of the methodology.

The content of the methodology was based on the principle of health promotion, including the increase of functional capabilities of the organism in the process of physical exercises. The program took into account the age specifics of development of 10-11 years old children and included progressive methods of teaching martial arts: multiple repetitions within the framework of variability of exercises were used.

The integration of the competitive method into the physical education program took place through wushu training with the development of a sense of competition in 10-11 years old children. According to Chinese methodology, this method contributes to the formation of children's interest in physical culture, improvement of motor skills and general improvement of physical fitness. In this regard, elements of rivalry were included in the curriculum, which increased children's motivation to practice martial arts by developing their competitive mindset.

Development of strength abilities.
The competitive element, expressed in mini-competitions for the number of repetitions or holding certain positions (e.g., static stances), awakened a competitive spirit in the students. They strived to surpass not only themselves but also their comrades, which strengthened their intrinsic motivation and will to win.

Developing endurance through prolonged exercise.

Performing prolonged exercises helped students cope with increasing fatigue and maintain concentration even under difficult conditions.

A competitive element such as relay races or group endurance tasks (e.g. team sparring) taught children to work through fatigue, developing their resilience and coping skills.

Developing quickness through reaction speed exercises.

Exercises designed to develop quickness (e.g. paw kicks or quick moves) allowed pupils to improve their skills.

The competitive element, which included contests for speed of kicks, moves, or reactions (e.g., who can perform a combination faster), encouraged a competitive spirit and the pursuit of excellence.

Developing flexibility through stretching and performing complex technical elements (e.g. high kicks) - helped students feel more confident in their movements.

Competitive element: competitions for the best stretching or performing difficult elements (e.g. twine) motivated children to work on themselves.

Development of coordination abilities through the performance of complex technical combinations and balance exercises - helped students to better control their movements.

Competitive element: holding competitions for accuracy in the execution of techniques (e.g. hitting a target) or balance (e.g. standing on one leg) - developed attention to detail and striving for perfection.

Cohesion and creativity. Group exercises (e.g. pair sparring, team relay races) - developed a sense of cohesion and teamwork.

Competitive element: team competitions (e.g., group duels or time trials) taught children to support each other, which strengthened their team spirit and healthy competition.

Biomechanical structure of movements. Improvement of exercise technique (e.g., correct placement of kicks, blocks) - helped students feel more confident in performing complex movements.

Competitive element: holding competitions on technique (e.g., who will perform a combination better) stimulated the desire for perfection and developed critical thinking.

Physical activity standards

In accordance with the requirements of the Health Standard of the People's Republic of China ("Physical Activity Requirements for Primary and Secondary School Students"), the following parameters were taken into account when developing the course:

The average heart rate of students was in the range of 130-170 beats per minute;

The density of physical activity in physical education classes was 30-40%;

For martial arts classes, the density of exercises was increased to 40-50%; for martial arts classes, the density of exercises was increased to 40-50%; for martial arts classes, the density of exercises was increased to 40-50%.

III. Results and discussion

At the first stage of the study, the physical fitness of junior schoolchildren was assessed using pedagogical tests (Table 1)

Table 1 - Baseline indicators of physical development and physical fitness of EG and CG boys and girls aged 10-11 years old in experimental and control groups($\overline{X} \pm S_{\overline{X}}$)

Tests	1		P	2		P
	EG	CG		EG	CG	
Body length, cm	136,69±6,24	137,31±6,20	>0,05	137,13±6,07	137,54±6,39	>0,05
Body weight, kg	31,23±6,44	31,71±6,39	>0,05	33,13±5,97	30,83±5,13	>0,05
Vital capacity of lungs, ml	1995,57±343,69	1901,29±360,74	>0,05	1771,51±364,99	1671,34±387,76	>0,05
Running 50 m, s	9,86±0,97	10,09±8,14	>0,05	9,86±0,97	10,09±8,14	>0,05
Flexibility, forward bend, cm	7,43±7,33	6,58±6,02	>0,05	11,50±5,94	11,14±5,69	>0,05
Torso lifts from lying position in 1 min, times	33,34±9,82	29,31±11,10	>0,05	29,97±7,48	29,34±7,75	>0,05
Jumping rope in 1 min, times	127,54±33,02	129,06±34,36	>0,05	116,69±27,57	127,26±39,40	>0,05
Shuttle Run 8×50 m, s	125,97±16,28	124,26±15,35	>0,05	122,37±13,31	124,97±1,89	>0,05
Long Jump, cm	171,11±16.09	175,29±17,99	>0,05	167,57±18,85	170,89±19,76	>0,05
High jump, cm	199,74±18,64	198,94±20,52	>0,05	192,54±16,98	193,00±19,60	>0,05
Ruler catch, cm	27,14±11,08	26,66±11,98	>0,05	29,14±10,98	31,03±13,19	>0,05
Balance on right leg, s	56,29±24,48	55,78±19,88	>0,05	68,83±24,23	70,06±21,64	>0,05
Balance on left leg, s	57,55±29,74	60,29±28,15	>0,05	72,71±26,96	69,34±26,95	>0,05
Squat "on horseback", s	86,03±34,63	76,91±36,17	>0,05	63,91±28,04	65,63±27,51	>0,05
"Plank", s	71,31±32,40	68,71±29,17	>0,05	70,31±31,92	67,71±32,85	>0,05

Note: 1 - boys; 2 - girls; P - reliability of differences.

Before the experiment, there were no significant differences in the overall mean physical fitness scores of boys and girls from EG and CG ($P > 0.05$). This corresponded to the requirements of the experiment and allowed for pedagogical interventions. Anthropometric indices of children also had no significant differences between the groups, which confirmed their comparability at the initial stage of the study. Post-experimental data reflecting basic and specific physical fitness of Wushu students are presented in Tables 2 and 3.

Intragroup indicators of physical development and physical fitness of 10-11 years old girls EG and CG before and after the experiment are presented in Table 2.

Table 2 - Intragroup indicators of physical development and physical fitness in girls 10-11 years old EG and CG before and after the experiment($\overline{X} \pm S_{\overline{X}}$)

Tests	EG		P	CG		P
	1	2		1	2	
Body length, cm	137,13± 6,07	147,75± 7,79	<0,001	137,54±6,40	142,69±8,3	<0,001
Body weight, kg	33,13±5,97	37,60±7,25	<0,001	30,83±5,13	35,44±7,21	<0,001
Vital capacity of lungs, ml	1771,51±364,99	2210,80±394,35	<0,001	1671,34±387,76	1928,57±494,32	<0,05
Running 50 m, s	9,86±0,96	9,25±0,87	<0,05	10,09±0,81	9,89±0,97	<0,05
Flexibility, forward bend, cm	11,50±5,94	19,78±4,74	<0,001	11,14±5,69	9,83±6,60	>0,05
Torso lifts from lying position in 1 min, times	29,97±7,48	47,89±8,28	<0,001	29,34±7,75	32,00±12,30	>0,05
Jumping rope in 1 min, times	116,69±27,57	149,66±26,27	<0,001	127,26±39,40	144,77±35,13	<0,05
Shuttle Run 8×50 m, s	122,37±13,31	109,46±14,03	<0,001	124,97±11,17	113,11±10,88	<0,001
Long Jump, cm	167,57±18,85	181,14±21,27	<0,01	170,89±19,76	179,80±21,72	<0,05
High jump, cm	192,54±16,98	214,11±18,16	<0,001	193,00±19,60	195,49±19,27	>0,05
Ruler catch, cm	29,14±10,98	20,60±8,96	<0,01	31,03±13,19	27,20±11,21	<0,05
Balance on right leg, s	72,71±26,96	135,06±50,17	<0,001	69,34±26,95	79,46±37,0	>0,05
Balance on left leg, s	63,91±28,04	200,86±96,06	<0,001	65,63±27,51	78,40±46,82	>0,05
Squat “on horseback”, s	68,83±24,23	115,66±45,20	<0,001	70,06±21,64	86,11±36,89	<0,05
“Plank”, s	70,31±31,91	198,74±76,90	<0,001	67,71±32,85	77,71±42,11	>0,05

Note: 1– Baseline indicators; 2 – Final indicators; P - Reliability of differences.

The data presented in the table showed a significant improvement in the physical fitness of girls in the experimental group (EG) after 9 months of martial arts training. The differences between the indicators before and after the experiment were statistically significant ($P<0,01$), which confirmed the effectiveness of the methodology. The average physical fitness score of the girls significantly increased, which indicated the positive influence of the wushu methodology.

In the control group (CG), engaged in the standard program of physical education, there were also significant changes ($P<0.05$) in most indicators.

Results of physical fitness testing.

The EG subjects, who practiced Wushu methods, demonstrated significantly higher results of physical fitness compared to the CG, who practiced according to the official school program of physical education. In particular:

Indices of vital capacity of lungs improved by 25% ($P<0,01$).
Forward bend in sitting position improved by 72% ($P<0.01$).
The number of trunk raises per minute improved by 60% ($P<0.01$).
The number of jump rope jumps per minute increased by 28% ($P<0.01$).
The long jump from a standing position improved by 8% ($P<0.01$).
High jump in sitting position improved by 11% ($P<0.01$).
Coordination scores improved by 29% ($P<0.01$).

In addition, martial arts students showed significant improvements in balance, lower extremity strength, and cortical strength (86% (P<0.01), 214% (P<0.01), 68% (P<0.01), and 182% (P<0.01), respectively).

Intragroup indices of physical development and physical fitness in 10-11 years old boys of EG and CGbefore and after the experiment are presented in Table 3.

Table 3–Intragroup indices of physical development and physical fitness in 10-11 years old boys of EG and CGbefore and after the experiment are presented ($\overline{X} \pm S_{\overline{X}}$)

Tests	EG		P	CG		P
	1	2		1	2	
Body length, cm	136,69±6,24	145,22±6,85	<0,001	137,31±6,20	140,27±6,70	<0,001
Body weight, kg	31,23±6,44	38,07±7,10	<0,001	31,71±7,68	35,40±8,61	<0,001
Vital capacity of lungs, ml	1995,57±343,69	2302,03±461,81	<0,001	1901,29±360,74	2035,06±527,14	>0,05
Running 50 m, s	9,41±1,39	91±0,58	<0,05	10,04±1,29	75±1,16	<0,05
Flexibility, forward bend, cm	7,43±7,33	,85±2,99	<0,001	6,57±6,02	91±6,10	>0,05
Torso lifts from lying position in 1 min, times	33,34±9,82	52,40±7,06	<0,001	29,31±11,01	32,49±10,59	>0,05
Jumping rope in 1 min, times	127,54±33,02	155,40±17,37	<0,001	129,06±34,36	143,97±30,15	<0,05
Shuttle Run 8×50 m, s	125,97±16,28	08,09±11,30	<0,001	124,26±15,35	2,71±12,40	<0,001
Long Jump, cm	171,11±16,09	191,23±12,01	<0,01	175,29±17,99	85,66±18,60	<0,05
High jump, cm	199,74±18,64	13,54±11,85	<0,001	198,94±20,52	03,14±16,39	<0,05
Ruler catch, cm	27,14±11,08	,31±9,10	<0,001	26,66±11,98	25,14±12,44	>0,05
Balance on right leg, s	56,29±24,48	130,03±67,76	<0,001	55,77±19,88	69,66±36,07	<0,05
Balance on left leg, s	57,54±29,73	196,31±95,46	<0,001	60,29±28,15	75,86±39,62	<0,05
Squat “on horseback”, s	86,03±34,63	43,34±42,70	<0,001	76,91±36,17	3,94±40,90	>0,05
“Plank”, s	71,31±32,40	229,11±117,97	<0,001	68,71±29,17	02,31±65,99	<0.05

Note: 1– Baseline indicators; 2 – Final indicators; P - Reliability of differences.

As can be seen from the data presented in Table 3, physical fitness of EG boys before and after 9 months of Wushu training increased within statistically significant limits (P<0.01). In KG, where students were engaged in a standard physical education program, there were also significant improvements in most indicators (P<0.05. The analysis of data revealed that elementary school boys practicing Wushu according to the specialized method achieved significantly higher results in the tests reflecting the level of physical development and physical fitness compared to the CG, engaged in physical education classes according to the traditional program. In particular, the following improvements were recorded:

vital capacity of lungs increased by 15% (P<0.01);

speed of running for 50 m improved by 5% (P<0.01);

indicators in tests on forward bends and torso raises from the supine position improved by 140% (P<0.01) and 57% (P<0.01), respectively; results in jumping rope, long jump and touching height improved by 22% (P<0.01), 12% (P<0.01) and 7% (P<0.01), respectively.

In addition, performance in the hand-eye coordination test (ruler catching) improved by 25% (P<0.01). Students specializing in martial arts also showed significant improvements in the development of specific physical qualities:

balance improved by 131% (P<0.01);

lower limb strength improved by 241% (P<0.01);

trunk muscle strength improved by 221% (P<0.01).

Thus, the results of the study confirm that Wushu exercises based on a specialized methodology contribute to a significant increase in the level of physical fitness in primary schoolchildren compared to traditional physical education lessons.

IV. Conclusions

1. Experimental methodology based on Wushu exercises promotes the development of motor coordination, strength, explosive power, flexibility and cognitive reflexes in elementary school students. A variety of basic Wushu exercises, including taolu elements, unlocks children's physical potential and contributes to their overall physical and cultural development.
2. Advantages of specialized classes. Unlike traditional physical education classes, where students change sports every 1-2 months, long-term Wushu training with the inclusion of competitive elements not only improves the physical development of 10-11 years old children, but also allows them to more deeply master the chosen sport. Thus it is experimentally proved that the method of improving physical fitness on the basis of Wushu exercises is effective for children of primary school age 10-11 years old.

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