

School physical education program variable component Sportization

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Abstract:

Research aim is to develop and test the variable school PE lesson technology sportization on order to improve children's aged 12-13 coordination and motor abilities level. *Materials and methods.* The pedagogical experiment was conducted on the basis of the secondary school in the All-Russian Children's Center «Orlyonok» (Krasnodar Territory, Russia). 40 children aged 12-13 participated in it. Control and experimental groups of 10 boys and 10 girls were formed. In both groups, PE classes were held 3 times a week for 45 minutes (102 hours per year). In the control group, classes were conducted according to the comprehensive school PE program in force in Russia. In the experimental group, two classes per week were conducted according to this program (68 hours per year). The third lesson (34 hours per year) was organized according to the variable PE lesson sportization technology developed by the authors. We used the game of table tennis in combination with a set of physical exercises performance on the Bosu Balance Pod (bosu) hemisphere to increase vestibular stability, balance function, coordination and motor abilities and agility. At the beginning and at the end of the pedagogical experiment, evaluation testing of coordination and motor qualities, static endurance and agility was carried out.

Research results. Before the pedagogical experiment, the motor-coordination qualities and agility indicators' values of children in the control and experimental groups did not significantly differ. After the experiment, there was a significant increase in the indicators' values in the children of the experimental group in all motor coordination tests and in all tests for statokinetic stability and agility. The indicators' values increase in all tests in the children of the experimental group was significantly greater than in the children of the control one. At the end of the experiment, the children of the experimental group registered the greatest increase in the indicators' values in the tests for upper limb muscle strength and active flexibility, for coordination readiness and agility, the increase in static endurance time was greater than in the children of the control one. *Conclusions.* Table tennis equipment and the Bosu Balance Pod simulator use allowed us to expand the school PE program variable component sportization technology. In the children of the experimental group, the increase in the values of motor and coordination qualities, vestibular and static stability and agility is significantly higher than in the children of the control one, who were engaged in the traditional curriculum. We believe that school PE program variable component sportization technology testing was successful, this fact is confirmed by the positive results of children's of the experimental group survey.

Key Words: schoolchildren (students), physical education (PE), school program, sportization

Introduction

Currently, the educational process level and quality in educational institutions increases significantly with the regular use of effective methods to improve the students' performance using physical education (PE) tools (Skead & Rogers, 2016; Potop et al., 2017; Zurita-Ortega et al., 2019).

High intellectual and psychoemotional loads in modern educational institutions (Demirci & Toptaş, 2018) are associated with young people's low physical activity (Olafsdottir et al., 2016; Gerber et al., 2017;

Korolenko, 2020), with computerization of educational activities (Yang & Dong, 2017) and violation of a healthy lifestyle basics (Pop, 2018; Pengpid et al., 2019; Lastkov & Dubovaya, 2020). This significantly worsens students' physical, mental and somatic health (Bakiko et al., 2020). The traditional PE system in general education institutions does not ensure students' health maintenance and improvement in the learning process (Moskovchenko et al., 2019). The difficult situation with the younger generation's health constantly activates scientists to search for new PE technologies in school educational institutions (Kolumbet & Dudorova, 2016; Kolokoltsev et al., 2021). There are reports of an increase in students' health level and normalization of their body component composition in the educational process when using strength training and endurance exercises (Görner & Reineke, 2020; Mischenko et al., 2020).

The modern scientific and methodological literature presents the results of the game-oriented sports technologies effective use in PE educational process (Montesano, 2018; Papandopulo, & Tomilin, 2020). Other researchers point to students' independent leisure activities sportization importance (Andrieieva & Hakman, 2018; Fedotova et al., 2020).

In the arsenal of sports disciplines, used in students' PE educational process, there is table tennis, as a means of health-improving orientation (Baidiuk et al., 2019). The authors found a significant improvement in the children's cardiovascular and respiratory systems activity after 10 months of using table tennis in the recreational program of physical training, compared with the traditional curriculum.

Tennis players' motor load includes high-speed and high-speed power work, which requires a high level of general and special endurance manifestation. Physical exercises from table tennis allow full using the game method to strengthen the nervous system, improve the metabolism and work of all functional systems of children's body (Paliichuk et al., 2018). Table tennis is an effective means of developing coordination and speed-strength abilities, motor reaction speed, movements frequency, flexibility and general endurance (Ansodi et al., 2018). There is literature data on the positive impact of table tennis on a person's physical development (Ioannis et al., 2015). This sports game does not require large material and financial costs (Lyakh & Zdanevich, 2012).

Table tennis can be widely used during long breaks between school sessions, as daily exercises in extended day groups and in the extracurricular organization of children's physical activity (Andrieieva, Hakman, 2018). At the same time, the educational value of physical education increases significantly when using physical activity in free time between lessons or when the child is at home (Biino et al., 2020).

In the literature, there is information about improving the effectiveness of traditional PE programs for young tennis players (Baidiuk et al., 2019). The age of 12-13 is a sensitive period of the child's vestibular stability and coordination abilities development (Willwéber & Čillík, 2017). Other authors' works confirm the close relationship between motor, coordination qualities and vestibular stability of a person (Ljubojević, Bojanić et al., 2016). We believe that new programs creative complexes of special physical exercises aimed at children's aged 12-13 engaged in table tennis body's coordination abilities and vestibular stability development and testing in PE classes at school are relevant to improve the students' performance.

We believe that the study of these issues will increase the PE classes' effectiveness for students aged 12-13 and significantly improve younger generation's physical health.

Material & methods

Research aim is development and testing of the variable school PE lesson technology sportization to improve children's aged 12-13 coordination and motor abilities level. The pedagogical experiment was conducted on the basis of the secondary school in the All-Russian Children's Center «Orlyonok» (Krasnodar Territory, Russia). 40 children aged 12-13 participated in it. Control and experimental groups of 10 boys and 10 girls were formed. In both groups, PE classes were held 3 times a week for 45 minutes (102 hours per year). In the control group, classes were conducted according to the comprehensive school PE program in force in Russia (Lyakh & Zdanevich, 2012).

In the experimental group, two classes per week were conducted according to this program (68 hours per year). The third lesson (34 hours per year) was organized according to the variable PE lesson sportization technology developed by us. In addition to theoretical and practical learning and mastering the elements of table tennis game, it is proposed to perform a creative set of physical exercises to improve young tennis players' vestibular stability, balance function, coordination and motor abilities and agility. This complex contained 10-12 special physical exercises with a tennis racket in hand, which were performed on the Bosu Balance Pod (bosu) hemisphere in the main part of the lesson and accounted for 30% (13-15 minutes) of the total duration of the lesson. Physical exercises on the hemisphere were performed in static mode from different starting positions standing on one or two legs with open and closed eyes with different hand positions. In dynamic mode, the steps, jumps, full squats, running with a high hip lift, and other exercises were performed on bosu.

In the experimental group, the conjugate training method was used, when children simultaneously formed the skills and abilities of table tennis and developed coordination and motor abilities, vestibular stability and agility. Also, the lesson used preliminary and special exercises aimed at teaching technical and tactical techniques of table tennis.

The students' physical qualities control assessment of was carried out at the beginning and at the end of the pedagogical experiment based on the motor tests results: running 30 m (s); running 6 minutes (m); standing long jump (cm); leaning forward from a sitting position (cm); pull-up on a high crossbar (number of times) for boys; pull-up on a low crossbar (number of times) for girls. The coordination abilities assessment was carried out using the following tests: side vaults over a bench in 30 seconds(number of times); jumping rope in 30 seconds (number of times); three forward rolls (s.); running on the gym bench (s). To determine the students' static equilibrium state, the Romberg - 2 functional test was used (Khasnis & Gokula, 2003).

This study does not infringe on the rights and does not endanger the students' well - being in accordance with the ethical standards of the Committee on Human Rights of the Helsinki Declaration of 2008 (WMA Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects). We used the methods of parametric statistics with the calculation of the reliability of differences in the t-Student criterion.

Results

Table 1 shows the boys' of the observed groups physical fitness, coordination readiness and agility indicators before and after the pedagogical experiment.

Table 1. Indicators values of motor and coordination readiness and agility of boys engaged in different educational programs before and after the pedagogical experiment (M±m)

Tests	Control group (n=10)		Experimental group (n=10)	
	Before the experiment	the experiment	Before the experiment	the experiment
Physical fitness				
Running 30 m (s)	6,2±0,3	5,8±0,3	6,1±0,4	4,9±0,4*
Running 6 minutes (min)	987±13,6	1132,0±15,0*	992±13,7	1253,0±15,6*
Standing long jump (cm)	163,8±3,2	165,2±3,3	162,9±2,8	172,4±4,2*
Pull-up on a high crossbar (number of times)	5,5±0,2	6,0±0,4	5,4±0,6	9,0±0,5*
Leaning forward from a sitting position (cm)	4,2±0,3	5,0±0,4	4,4±0,6	7,0±0,6*
Coordination readiness and agility				
Side vaults over a bench in 30 seconds (number of times)	9,8±0,6	12,0±0,8*	9,7±0,6	17,0±0,8*
Jumping rope in 30 seconds (number of times)	20,2±1,3	26,0±1,6*	21,2±1,5	32,0±1,9*
Three forward rolls (s)	5,5±0,6	4,8±0,4	5,9±0,6	3,9±0,3*
Running on the gym bench (s)	30,5±2,3	25,0±1,8	31,0±1,9	21,0±2,5*

Note. * significance of differences in the indicators values is established ($p < 0.05$)

Prior to the pedagogical experiment, there were no significant differences between the motor-coordination qualities and agility values of boys in the control and experimental groups ($p > 0.05$).

After the pedagogical experiment, the boys of the control group showed a significant increase in the indicators values in only one of the five motor tests and two coordination tests (Table1). The boys of the experimental showed a significant increase in the values of all motor and coordination tests in the test of skill (Table 1).

The increase in the motor tests values in boys of the control and experimental groups is shown in Fig.1, the increase of the coordination abilities and agility indicators values is shown in Fig.2.

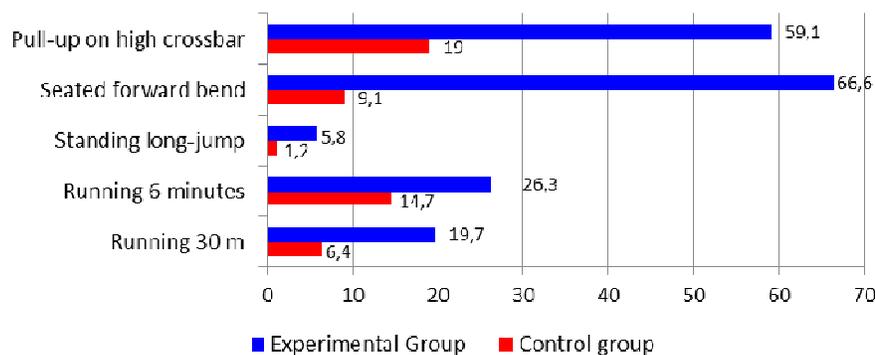


Fig. 1. The increase in the motor tests values in boys at the end of the experiment (%)

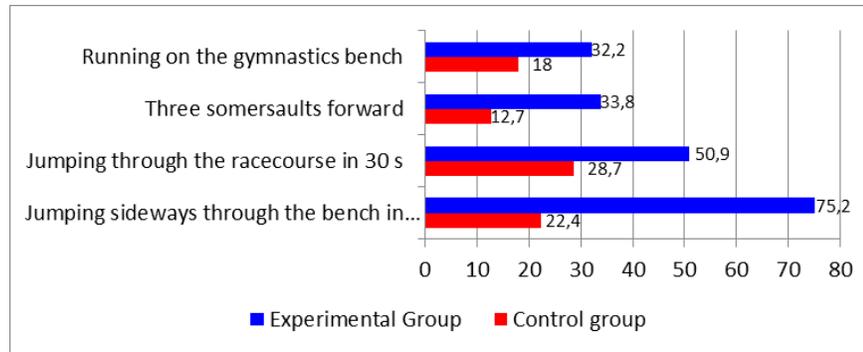


Fig. 2. The increase of the coordination abilities and agility indicators values in boys at the end of the experiment (%)

According to the figures, at the end of the experiment, the greatest increase in the indicators values of physical fitness (Fig.1), coordination readiness and agility (Fig.2) was observed in the boys of the experimental group, compared with the test results of the boys of the control one. At the end of the experiment, the greatest increase in physical fitness of the boys from the experimental group was noted in the test «Pull-up on a high crossbar» by 66.6% and in the test «Leaning forward from a sitting position» by 59.1%. In coordination readiness and agility in the test «Side vaults over a bench in 30 seconds» by 75.2% and the test «Jumping rope in 30 seconds» by 50.9%. Table 2 shows the girls' of the observed groups physical fitness, coordination readiness and agility indicators before and after the pedagogical experiment.

Table 1. Indicators values of motor and coordination readiness and agility of girls engaged in different educational programs before and after the pedagogical experiment (M±m)

Tests	Control group (n=10)		Experimental group (n=10)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
Physical fitness				
Running 30 m (s)	6,8±0,4	6,2±0,3	6,7±0,4	5,0±0,2*
Running 6 minutes (min)	956±13,5	1031,3±14,2*	950±13,3	1120,3±14,3*
Standing long jump (cm)	148,5±3,0	151,2±3,3	149,9±2,8	165,3±2,9*
Pull-up on a low crossbar (number of times)	11,5±0,8	13,0±0,9	11,0±0,9	18,0±1,2*
Leaning forward from a sitting position (cm)	7,2±0,7	9,0±1,2	7,4±0,6	12,0±1,1*
Coordination readiness and agility				
Side vaults over a bench in 30 seconds (number of times)	8,8±0,6	10,0±1,4	8,7±0,6	13,0±1,6*
Jumping rope in 30 seconds (number of times)	18,2±1,1	22,0±1,8	18,2±1,1	26,0±1,9*
Three forward rolls (s)	5,5±0,6	4,9±0,6	5,6±0,6	4,0±0,4*
Running on the gym bench (s)	35,5±3,1	29,5±2,8*	35,0±3,0	26,0±2,0*

Note. * significance of differences in the indicators values is established ($p < 0.05$)

After the pedagogical experiment, the girls of the control group showed a significant increase in the indicators values in one of the five motor tests and in the agility test (Table 2). The girls of the experimental group showed a significant increase in the values in all motor and coordination tests and in the agility test (Table 2). The increase in the motor tests values in the girls of the control and experimental groups is shown in Figure 3, the increase in the indicators values of coordination abilities and agility dexterity is shown in Figure 4

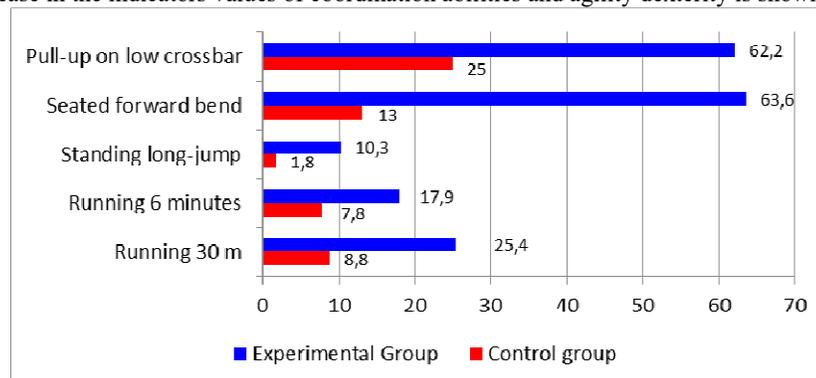


Fig. 3. The increase in the motor tests values in girls at the end of the experiment (%)

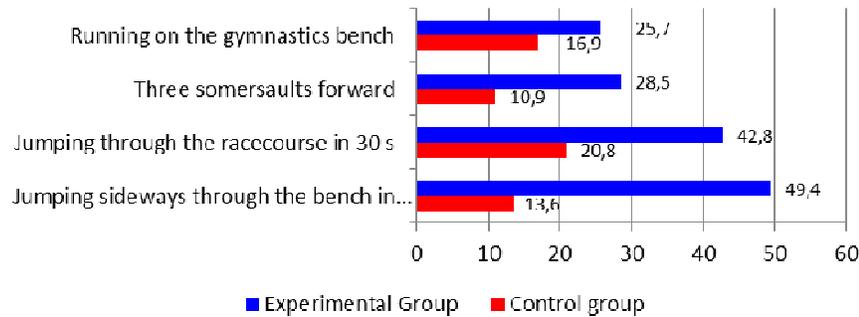


Fig. 4. The increase of the coordination abilities and agility indicators values in girls at the end of the experiment (%)

As shown in the figures, at the end of the experiment, the greatest increase in the physical fitness values (Fig.3), coordination readiness and agility (Fig.4) was observed in the girls of the experimental group, compared with the results of testing girls in the control one.

At the end of the experiment, the greatest increase in physical fitness of the girls of the experimental group was noted in the test «Pull-up on a low crossbar» by 62.2% and in the test «Leaning forward from a sitting position» by 63.6%. In coordination readiness and agility in the test «Side vaults over a bench in 30 seconds» by 49.4% and the test «Jumping rope in 30 seconds» by 42.8%.

The results of the boys' and girls' of both study groups static stability study are shown in Figure 5.

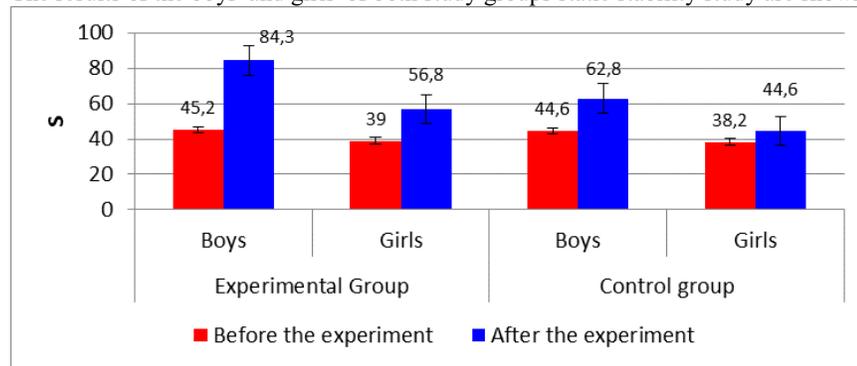


Fig. 5. The Romberg-2 test value in boys and girls of both observation groups at the beginning and at the end of the pedagogical experiment (s)

Figure 5 shows that at the end of the observation, the static endurance time increased by 39.1 seconds (86.5%) in the experimental group of boys, and by 18.2 seconds (40.8%) in the control group of boys. In girls, the static endurance time increased by 17.8 seconds (45.6%) in the experimental group and by 6.4 seconds (16.7%) in the control group.

Dicussion

The development, search and testing of various methods and means of improving the PE effectiveness of students continue to be relevant problems of pedagogy (Kolumbet, Dudorova, 2016), this fact confirms the chosen research direction importance. According to the authors (Montesano, 2018), sports technologies use in students' PE educational process is a promising direction in young people's physical training. Table tennis, as a sport, is recognized as one of the best means of improving the body, strengthening human health and physical training effectiveness (Baidiuk et.al., 2019), it explains our choice of school students' curriculum of physical education PE program variable component sportization. The relationship between a person's motor, coordination qualities and vestibular stability is reported by Ljubojević, M., Bojanić, D. (2016). With the coordination abilities and vestibular stability development, the development of other motor qualities is noted (Wilczyński, 2018), this fact is confirmed by this study. The use of the school students' PE program of the experimental group, where physical exercises on the Bosu Balance Pod hemisphere were combined with table tennis, allowed to significantly improve the children's physical and coordination qualities, vestibular stability and agility, compared with the results of children from the control group, where lessons were conducted according to the traditional school PE program. This is confirmed by the results obtained by us of a significant improvement in the indicators values of coordination, motor tests and agility, the Romberg - 2 test in boys and girls of the experimental group. The use of the PE program by students of the experimental group, where physical exercises on the Bosu Balance Pod hemisphere were combined with table tennis, allowed us to significantly improve the

children's physical and coordination qualities, vestibular stability and agility, compared with the results of children of the control group, in which lessons were conducted according to the traditional school PE program. This is confirmed by the results obtained by us of a significant improvement in the indicators values of coordination, motor tests and agility, the Romberg - 2 test in boys and girls of the experimental group. The students we observed at the age of 12-13 continue to remain in a sensitive period of vestibular stability, coordination abilities and agility development, which is consistent with the results of a study by other authors (Willwéber, Čillik, 2017). We believe that the educational programs designing and pedagogical technologies choice for school students' PE should be based on the features of the children's sensitive period of physical qualities development, which increases physical culture and sports effectiveness in educational institutions.

Conclusions

The use of table tennis facilities and the developed set of physical exercises performed on the Bosu Balance Pod hemisphere allowed expanding the school PE education program variable component technology of sportization. In the children of the experimental group, the increase in the indicators values of motor and coordination qualities, vestibular, static stability and agility was significantly higher, compared with the increase in the indicators values of the same qualities in boys and girls of the control group, who were engaged in the traditional school curriculum. Taking into account the sensitive period for the favorable development of children's aged 12-13 vestibular stability, coordination abilities and agility, we selected the bosu simulator for testing the curriculum. The results of our experiment indicate the correctness of this means pedagogical technology choice, which is confirmed by significantly greater results of the increase in the indicators values of coordination-motor tests and tests for static stability, compared with the results of the children in the control group. Sports equipment for playing table tennis and the bosu platform do not require significant material and financial costs. Therefore, this sports equipment can be used both in organized PE classes, and for independent physical exercises between and after classes and at home.

We believe that the variable component of the school PE program should not be limited only to the sportization of physical education training session. To increase students' educational process and motivation effectiveness, non-traditional forms and methods of conducting classes should be used. We consider this direction of young people's physical education promising.

Conflicts of interest: The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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