

Schoolchildren's motivation to increase motor activity using the footbag freestyle game

NATAL'YA MISCHENKO¹, MIKHAIL KOLOKOLTSEV², ELENA ROMANOVA³, ANTON VOROZHEIKIN⁴, ELENA IVANOVA⁵, IRINA SUSLINA⁶

¹Department of Theory and Methods of Physical Education, Ural State University of Physical Culture, RUSSIA

²Department of Physical Culture, Irkutsk National Research Technical University, RUSSIA

³Department of Physical Education, Altai State University, Barnaul, RUSSIA

⁴Department of Information Technologies, Kaliningrad Institute of Management, Kaliningrad, RUSSIA

⁵Department of Emergency Rescue Technology and Automotive Economy, GPS Emercom of Russia St. Petersburg University, RUSSIA

⁶Department of Philosophy and Social Sciences, GPS Emercom of Russia St. Petersburg University, RUSSIA

Published online: September 30, 2021

(Accepted for publication September 15, 2021)

DOI:10.7752/jpes.2021.05354

Abstract:

Research aim is to show experimentally the possibility of «Footbag» pedagogical game technology for increasing children's motivation to motor activity. *Materials and methods.* The study was conducted at a secondary school in Orsk (Russia). The control and experimental groups of boys aged 11-12 were identified. During the academic year, three PE lessons per week in the control group and two lessons in the experimental group were conducted according to the traditional comprehensive PE program for general education schools in Russia. The third PE lesson in the experimental group was conducted according to the variative program developed by us using «Footbag-freestyle» game. In all children, the milestone level of motivation for motor activity was assessed, physical fitness was studied with the help of motor tests, and the functional characteristics of the children's body were studied. *Research results.* At the end of the pedagogical experiment, the children of the experimental group showed a significant increase in the motivation level to engage in PE lessons at school and to independent physical activity, positive dynamics of the cardiovascular, respiratory and muscular systems were noted, the values of the motor tests indicators significantly increased. The motor density of the school PE lesson has increased. *Conclusions.* The program of «Footbag» pedagogical game technology developed by us allowed increasing the schoolchildren's aged 11-12 physical education effectiveness. The boys of the experimental group had a high level of motivation for daily motor activity, the values of all motor qualities indicators (with the exception of general endurance) and functional indicators of the cardio-respiratory and muscular systems significantly increased, compared with the children's of the control group results. The use of «Footbag» pedagogical game technology is proposed to increase the motivation to improve the motor mode of a person of any age.

Key Words: Physical education (PE), footbag, schoolchildren's aged 11-12, motivation to motor activity

Introduction

Children's, adolescents' and youth's health preservation and strengthening is a priority task of the education sector of state and public organizations in various countries (W.H.O., 2020; Korolenko, 2020). Such attention to young people is explained not only by generally accepted moral and ethical categories, but also by significant negative characteristics of modern younger generation's health (Singh et al., 2020; Tortella, et al., 2021; Clemens Drenowatz, 2021; Tomás Reyes-Amigo, 2021).

The use of only therapeutic measures in maintaining and strengthening the population health did not lead to its improvement, including among young people (Ng, et al., 2014; Bakiko, et al., 2020; Grebenyuk et al., 2020). In recent years, the situation with children's somatic and mental health has worsened due to a decrease in their physical activity level (Guthold et al., 2019), due to the COVID-19 pandemic (Bates et al., 2020).

New pedagogical technologies, aimed at improving the health level of various population groups are emerging (W.H.O., 2020; Wojciech Marynowski, 2021). According to the recommendations of the World Health Organization, children and young people under the age of 17, should engage in physical activity daily for at least 60 minutes (1 hour) or 7 hours a week in order to maintain the existing level of health, in the range of intensity from moderate to high. This can be PE classes at school and independent physical activity during the day (Kolokoltsev et al., 2021). Students who fulfill this standard of physical activity have a high level of health, compared with children who do not fulfill the WHO recommendations on motor mode (Janssen, 2007).

The literature provides data indicating schoolchildren's large academic load with academic subjects, a low level of teaching PE at schools, insufficient funding and support from the management of educational

institutions of the educational process in this discipline (Hills et al., 2015). There are also subjective reasons for the low efficiency of physical education (PE) classes at schools.

There is conflicting information about the influence of PE classes' intensity at school over the compensation of the child's daily motor activity. In the works of Morgan et al. (2007); Tomás Reyes-Amigo (2021) it is shown that performing moderate and low-efficiency physical activities in PE classes does not lead to significant compensation for schoolchildren's daytime motor activity. According to Gea-García et al. (2020), school PE classes increase the level of daily motor activity. In the scientific work of Kerr et al. (2016) it is found that the use of high-intensity physical exercises in PE classes at school increases children's overall daily activity.

The number of school PE lessons can influence the implementation of the recommended daily norm of motor activity by children. A study by Silva, Chaput, & Tremblay (2019) shows that attending PE classes 3 times a week allows children to achieve the recommended daily rate of motor activity. The program of the third PE lesson at school is variable and is compiled by the teacher taking into account the state of the sports base, the national and regional component, the educational and sports level of the PE teacher. These can be various sports training programs based on the democratic principles of freedom of choice of the pedagogical technology of the lesson.

Motivation for physical activity is the most important aspect, not inferior in importance to the process of performing physical exercises. Therefore, in any training program of physical culture and sports, the principle of regular motivation, an active attitude to arbitrary self-improvement and self-development of a person is laid down (Slepchenko et al., 2019).

The scientific literature does not sufficiently reflect the issues of «Footbag» game technology use in the variable component of the PE lesson and its impact on the physical fitness level, schoolchildren's motivation to motor activity and compensation for the recommended daily motor activity. It is known that «Footbag» game is an accessible, safe, high-intensity sports game with simple rules (Nikishchenko, Zakharova, 2016). «Footbag» forms such important motor qualities as strength, agility, movements' coordination, speed, increases children's health level and meets their needs and interests (Mishchenko, 2020).

We believe that the testing of pedagogical game technology in schoolchildren's PE educational process will increase the children's interest and motivation to independent physical activity, improve the schoolchildren's body physical and functional indicators and expand their motor mode.

Research aim is to show experimentally the possibility of «Footbag» pedagogical game technology for increasing children's motivation to motor activity.

Material & methods

The research was conducted in secondary school No. 4 in Orsk (Russia). The control (n=20) and experimental (n=20) groups of boys aged 11-12 were formed by a randomized selection method. In both groups, school PE lessons were held 3 times a week for 45 minutes each. In the warm season, lessons were held at the outdoor school stadium

During the 2019-2020 academic year, three PE lessons in the control group and two lessons in the experimental group per week were conducted according to the comprehensive PE program for general education schools in Russia (Lyakh, Zdanevich, 2004). The third PE lesson (45 minutes) in the experimental group provided for conducting classes according to the program proposed by us using the «Footbag-freestyle» game. In the academic year, there were 30 such lessons, the volume of which in the annual planning was 28.6% (Table 1).

Table 1. The third PE lesson plan in the experimental group

Lesson structure	Task time (min)	Lesson content
Warming-up	8	Walking, running, general physical exercises for all muscle groups
Basic part	10	Exercises for leg strength and coordination (work on the «bosu» platform, with a rope, an inflatable log, a soccer ball and a ball Ø10 cm). Gymnastic and acrobatic exercises.
	20	Learning and fixing basic «Footbag» exercises
Concluding part	7	Reflection: exercises for muscle relaxation, breathing exercises, viewing thematic videos with a teacher's comment. Homework for self-training with «Footbag-freestyle».

At the experimental lesson, the children got acquainted with the techniques of self-insurance and the basics of «Footbag-freestyle» game. We worked individually and in pairs. We learned and fixed the basic exercises of catching the ball with the foot, rebounding and the height of the ball flight: stall on the forehead (Forehead Stall), freeze (stall) on the toe of the right (Right Toe Stall) or left foot(Left Toe Stall), inner freeze (stall) on the right and left foot (Inside Stall), neck catch (Neck Catch),), outer freeze (stall) on the right foot (Outside Frontside Stall), Sole kick (Sole).

The pedagogical experiment was conducted in several stages.

1. The initial stage (September). Conducting the first questionnaire of schoolchildren about their personal motivation level to engage in physical culture at school, about the children's motivation to engage in independent physical activity. Physical fitness and functional indicators of the schoolchildren's body testing. Sending homework to the schoolchildren's mobile phones: links to Web resources about methodological materials for the independent production of a «Footbag» sports subject, about equipment and rules of the game, familiarization with «Footbag» basic exercises.

2. The main training stage (October - March). In-depth study of «Footbag» complex exercises individually, in pairs and in the form of a team game to improve the basic motor qualities and functional indicators of the children's body.

3. The final stage (April - May). Improvement and consolidation of the pedagogical experiment results, repeated questioning of schoolchildren about motivation for motor activity, children's motor qualities and functional indicators control testing. Conducting the final competition.

At the beginning and at the end of the pedagogical experiment, the schoolchildren's physical fitness was monitored using motor tests: «running for 30 m», s; «shuttle running 4x9 m», s; «standing long jump», cm; «leaning forward from a sitting position», cm; «sit-up for 1 min», number of times; «rope jumping for 1 min», number of times; «running for 1000 m», m/s.

The functional parameters of the children's body were monitored. The dynamometer was used to study the hands muscles strength of the right and left hands (kg), the spirometer was used to determine the lungs vital capacity (ml). The heart rate was recorded at rest and after physical exertion (20 squats in 30 seconds), beats/min. In conventional units, the Ruffier index, characterizing the reserve capabilities of the cardiorespiratory system was calculated, according to the results evaluation scale for the age of 11-12. The body's resistance to hypoxia was determined by holding the breath on inspiration (timed inspiratory capacity, or Stange's test).

The work was carried out in compliance with the ethical rules of the Committee on the Rights of Children of the Helsinki Declaration of 2008 (World Medical Association Declaration of Helsinki, 2013), the consent of parents to conduct a safe examination for the well-being of children was obtained.

A statistical analysis was performed with the calculation of the average value (M), minimum, maximum, standard deviation (σ), standard error (m) and the calculation of the Student's confidence criterion.

Results

Research results. At the beginning of the pedagogical experiment, the responses of children from the control and experimental groups showed a low level of motivation to engage in physical culture at school and in independent physical activity.

An important characteristic of human body adaptation to physical exertion is the functional indicators of the main physiological systems. For this purpose, a comparative analysis of the boys' cardio-respiratory and muscular systems state before and after the pedagogical experiment was carried out in both groups (Table 2).

Table 2. Milestone values of the boys' functional indicators (M±m)

Functional indicators	Control group (n=20)		Experimental group (n=20)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
Cardio-vascular system				
Heart rate at rest (beats per minute)	80,5±4,0	79,2±3,3	81,2±4,3	77,0±2,6
Heart rate after physical exertion 20 squats in 30 s (beats per minute)	119,2±5,6	116,3±4,3	118,8±5,4	96,2±3,7*
Ruffier index (relative units)	10,5±2,8	9,3±2,2	10,3±2,3	5,7 ±1,6*
Respiratory system				
Lungs vital capacity (ml)	2346,2±44,45	2454,5±46,32	2378,5±47,98	2757,2±49,15*
Stange's test (s)	43,6±3,3	48,2±3,7	42,3±3,2	59,6±4,0*
Muscle system				
Muscles strength of the right hand (kg)	21,9±1,2	23,2 ±1,5	20,8±1,3	26,7±1,9*
Muscles strength of the left hand (kg)	19,2±1,1	20,4±1,2	19,6±1,2	23,9±1,4*

Note. * - significant difference in the test indicators values after the experiment ($p < 0,05$)

Prior to the experiment, there were no significant differences between the boys of the control and experimental groups in the indicators values of the cardiorespiratory and muscular systems functional state activity.

After the pedagogical experiment, an increase in the indicators values in all functional tests was noted in both observed groups, Fig.1. The largest increase in indicators was reliably established only in boys of the experimental group (with the exception of the value of the heart rate indicator at rest). The increase in the

values of the hypoxic Stange's test and the Rufier index exceeds 40% in the experimental group and 10% in the control group of boys.

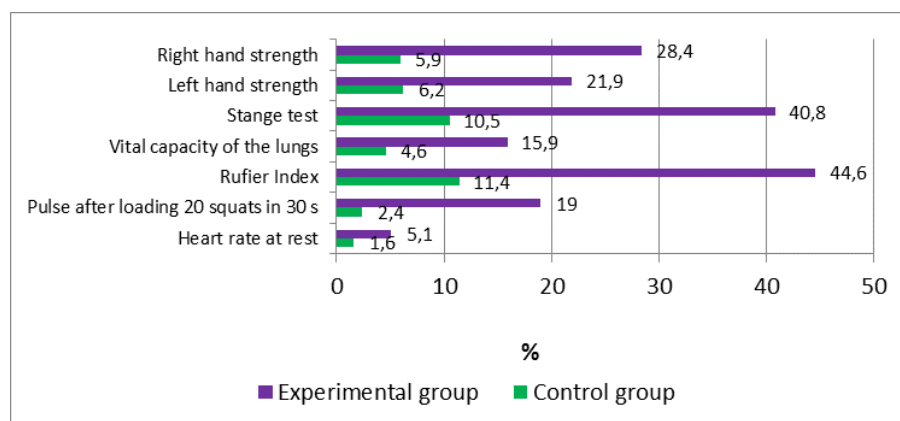


Fig. 1. Increase in the boys' at the end of the pedagogical experiment functional indicators values (%)

To assess the effectiveness of «Footbag» game use in physical education, a study of the children's physical fitness before and after the experiment was conducted (Table 3).

Table 3. Milestone values of the boys' physical fitness indicators (M±m)

Tests	Control group (n=20)		Experimental group (n=20)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
1. Running for 30 m, s	6,6±0,6	6,1±0,4	6,7 ±0,3	5,4±0,5*
2. Shuttle running 4x9 m, s	11,7 ±0,6	11,1±0,5	11,4±0,7	10,0±0,3*
3. Standing long jump, cm	150,2±2,9	158,6±3,3	148,8±3,9	169,2±4,4*
4. Leaning forward from a sitting position, cm	3,2±1,0	4,1±2,1	3,0±1,5	4,6±1,8
5. Sit-up for 1 min, number of times	26,8±1,4	30,0±3,0	25,7±2,9	37,5±3,3*
6. Rope jumping for 1 min, number of times	63,4±0,6	67,0±3,4	62,2±0,4	72,3±3,3*
7. Running for 1000 m, m/s	5,34±1,8	4,59±1,1	5,38±1,7	4,10 ±1,2

Note. * - significant difference in the test indicators values after the experiment (p<0,05)

Before conducting the pedagogical experiment no significant differences between boys' from experimental and control groups motor qualities were found.

After the experiment, an increase in the physical fitness indicators values was established in both observation groups (Fig. 2).

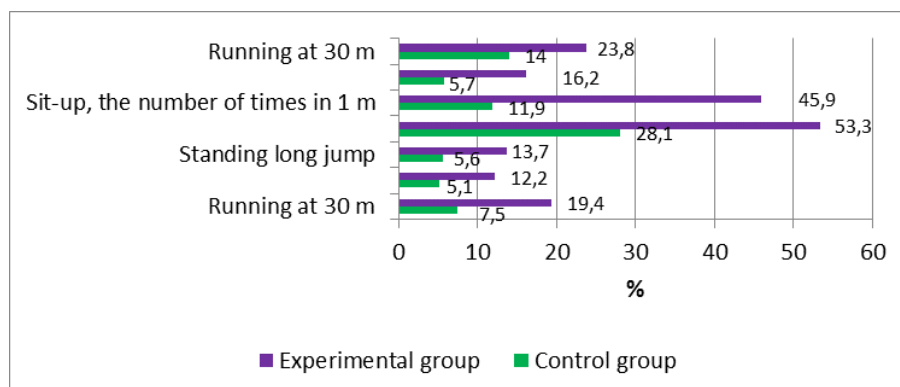


Fig. 2. The boys' increase in the physical fitness indicators values before and after the pedagogical experiment (%)

The results of all physical fitness tests in the boys of the experimental group were higher than in those of the control one.

The most significant increase in the values of the motor qualities indicators of children from the experimental group was noted in the test for the flexibility of the spine and hip joints (53.3%) and the strength abilities of the abdominal and back muscles (45.9%).

At the end of the pedagogical experiment, a positive dynamics of motivation for motor activity level was established in all boys of the experimental group, compared with the boys of the control one, where the increase in the motivation level was insignificant only in individual children. The daily motor activity of moderate and high intensity in the experimental group exceeded 60 minutes. In the control group, the time of daily physical activity is 56.6% less.

The effectiveness of the proposed experimental program is confirmed by the results of the PE lessons conducted timing. The motor density of lessons during the school year was 80% - 95% in the experimental group, 57% - 70% in the control one.

Dicussion

Physical inactivity (hypodynamia) is one of the main reasons for physical fitness indicators deterioration and a decrease in somatic and mental health levels of modern youth (Guthold et al., 2019; Ihor Bakiko et al., 2020; Tomás Reyes-Amigo et. al., 2021). According to some researchers (Drachuk et al., 2018), the reason for the decrease in PE classes effectiveness at school is the lack of students' motivation to motor activity. Therefore, the search for non-traditional means and methods of children's, adolescents' and young people's increasing motivation for motor activity is an important and relevant health-saving activity of educational institutions.

Every year, new types of physical culture and sports activities of a game orientation appear and develop in the world, which use a large group of methods and techniques for organizing the educational process of physical education. In contrast to performing the usual general physical exercises, physical activity occurring in game sports causes significant positive morphological changes in the human cerebral cortex (Berger et al., 2020). In active games, there is pleasure, occurring due to the production of dopamine in the body, which makes a person motivated to physical activity (Diamond, 2017), cognitive abilities and interest in physical activity develop (Valentina Biino et al., 2020). Children's outdoor games play a particularly important role (Singh et al., 2020; Tortella et al., 2021).

As our research results have shown, the proposed pedagogical game technology with the use of «Footbag» in the variable component of a school PE lesson allows forming children's interest and regular long-term motivation to motor activity.

After the experiment, the daily moderate and intensive motor activity of the children of the experimental group exceeded 60 minutes and corresponded to the global recommendations of the World Health Organization on motor activity. The results of our experiment on motivation for motor activity formation in adolescents are consistent with the data of studies conducted among students in secondary educational institutions in Spain (Zorio-Ferreres et. al., 2018). The authors managed to significantly increase physical activity outside of school PE hours, due to an increase in students' interest in physical culture and sports activities.

In our experiment, the final values of the motor tests indicators were significantly higher in children who were engaged in the variable program proposed by us, compared with the values of the indicators of schoolchildren who were engaged in the traditional curriculum. This fact can be explained by the increased interest and motivation of children to «Footbag» game.

Classes on the «Footbag» program caused a positive dynamics in the development of the boys' in the experimental group functional capabilities. There was an increase in the adaptation and reserve potential of the children's cardio-respiratory system to regular moderate and intensive physical exertion.

By the end of the observation, the children of the experimental group showed a slowdown in the heart rate at rest and after physical exertion («20 squats in 30 seconds» test), a decrease in the Ruffier index value, an increase in the body's resistance to hypoxia, as evidenced by a significant increase in the time in Stange's test with breath retention on inspiration and an increase in the vital capacity of the lungs. This fact does not contradict the results of other studies, devoted to respiratory and cardiovascular system of people engaged in physical exercises (Svyatova et al., 2018).

We believe that further study of the use of «Footbag» game in the physical education of schoolchildren is a promising direction of the program for students' health care.

Conclusions

The program of using «Footbag» game technology developed by us made it possible to increase the motor density of the PE lesson and increase the efficiency of the schoolchildren's aged 11-12 pedagogical process of physical education.

The boys of the experimental group, where «Footbag» was used in the PE lesson, showed a significant increase in the level of motivation for daily motor activity, which corresponds to the global recommendations of the World Health Organization on physical activity for this age category.

The indicators values of all motor qualities of schoolchildren of the experimental group (with the exception of general endurance) and functional indicators of the cardio-respiratory and muscular systems significantly increased compared with the results of children of the control one.

«Footbag» is a simple, accessible, safe game. The purchase of a «Footbag» ball does not require large financial costs; it is possible to manufacture it independently. The great popularity of «Footbag» among young people expands the possibilities of using it not only in PE classes, but also for independent studies in any room or outdoors.

We believe that the use of «Footbag» game pedagogical technology to increase the motor mode is a promising direction in the field of health saving of a person of any age.

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

References:

- Bakiko, I., Savchuk, S., Dmitruk, V., Radchenko, O., Nikolaev, S. (2020). Assessment of the physical health of students of middle and upper grades. *Journal of Physical Education and Sport*, Vol 20 (Supplement issue 1), Art 39, pp. 286 – 290, 2020. DOI:10.7752/jpes.2020.s1039
- Bates, L.C., Zieff, G., Stanford, K., Moore, J.B., Kerr, Z.Y., Hanson, E.D., Gibbs, B.B., Kline, C.E., & Stoner, B.L. (2020). COVID-19 Impact on behaviors across the 24-hour day in children and adolescents: Physical Activity, Sedentary Behavior, and Sleep. *Children*, 7(9), 138. DOI:10.3390/children7090138
- Berger, N., Lewis, D., Quartagno, M., Njagi, E. N., & Cummins, S. (2020). Longitudinal associations between neighbourhood trust, social support and physical activity in adolescents: evidence from the Olympic Regeneration in East London (ORiEL) study. *Journal of epidemiology and community health*, jech-2019-213412. Advance online publication.
- Clemens Drenowatz. (2021). Association of motor competence and physical activity in children – does the environment matter? *Journal of Physical Education and Sport*, Vol 21 (Supplement issue 1), Art 55, pp. 514 – 519, Feb.2021. DOI:10.7752/jpes.2021.s1055
- Diamond, A. (2017). What characteristics might physical activities need so they yield the most benefit to executive functions? Unpublished oral presentation presented at International Seminar & Workshop University of Rome – ForoItalico.
- Drachuk, S., Bohuslavskya, V., Pityn, M., Furman, Y., Kostiukevych, V., Gavrylova, N., Salnykova, S., Didyk, T. (2018). Energy supply capacity when using different exercise modes for young 17–19- year-old men. *Journal of Physical Education and Sport*, 18 (1), Art 33, pp. 246-254. DOI:10.7752/jpes.2018.0103
- Gea-García, G.M., González-Gálvez, N., Espeso-García, A., Marcos-Pardo, P. J., González-Fernández, F.T., & Martínez-Aranda, L.M. (2020). Relationship Between the Practice of Physical Activity and Physical Fitness in Physical Education Students: The Integrated Regulation as a Mediating Variable. *Frontiers in Psychology*, 11(July), 1–14. DOI:10.3389/fpsyg.2020.01910
- Grebenyuk, L.A., Gryaznykh, A.V., & Kiseleva, M.M. (2020). Comparative analysis of muscle texture anisotropy in orthopedic pathology and in conditions of increased regular training influences. *Man. Sport. Medicine*, 20 (S2), 98–104. DOI: 10.14529 / hsm20s216
- Guthold, R., Stevens, G. A., Riley, L.M. (2019) Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants, *Lancet Child Adolesc Health*, 4, 23–35.
- Hills, A. P., Dengel, D. R., & Lubans, D. R. (2015). Supporting Public Health Priorities: Recommendations for Physical Education and Physical Activity Promotion in Schools. *Progress in Cardiovascular Diseases*, 57(4), 368–374. DOI:10.1016/j.pcad.2014.09.010
- Janssen, I. (2007). Physical activity guidelines for children and youth. *Applied Physiology Nutrition and Metabolism*, 32, 109–121.
- Kerr, C., Smith, L., Charman, S., Harvey, S., Savory, L., Fairclough, S., & Govus, A. (2016). Physical education contributes to total physical activity levels and predominantly in higher intensity physical activity categories. *European Physical Education Review*, 24(2), 152–164. DOI:10.1177/1356336X16672127
- Kolokoltsev, M., Ambartsumyan, R., Gryaznykh, A., Krainik, V., Makeeva, V., Nonoyan, K., Romanova, E., Savchenkov, A., Mischenko, N., & Vrachinskaya, T. (2021). Physical activity amount influence over suboptimal health status. *Journal of Physical Education and Sport (JPES)*. Vol. 21 (1). pp. 381 - 387. DOI: 10.7752/jpes.2021.01037
- Korolenko, A. V. (2020). Physical health and its behavioral factors in the population assessment of the country and region: experience of the comparative analysis. *Health, Physical Culture and Sports*, 1(17), 4-25. DOI:10.14258/zosh(2020)1.1

- Lyakh, V. I., & Zdanevich, A. A. (2004). (2004). Comprehensive physical education curriculum for students in grades 1-11. M.: New school, 2004. (in Russian)
- Mishchenko, N. Yu. (2020). Influence of the third hour of a physical culture lesson in mini-football on physical development, functional state of the respiratory, cardiovascular system of 11-12 year old boys. *Physical culture and sports in the XXI century: actual problems and their solutions*. Collection of materials of the All-Russian scientific and practical conference with international participation (October 21-22). Vol.3. Volgograd: Federal State Budgetary Educational Institution of Higher Education, VGAFK, pp. 192-201. (in Russian)
- Morgan, C.F., Beighle, A., & Pangrazi, R.P. (2007). What are the contributory and compensatory relationships between physical education and physical activity in children? *Research Quarterly for Exercise and Sport*, 78(5), 407–412. DOI: [10.1080/02701367.2007.10599440](https://doi.org/10.1080/02701367.2007.10599440)
- Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., Mullany, E.C., Biryukov, S., Abbafati, C., & Abera S.F. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 384, 766–781.
- Nikishchenko, A. L., & Zakharova, N. A. (2016). Footbag in russia and the world: the history of formation and development. Actual problems and prospects of the theory and practice of physical culture, sports, tourism and motor recreation in the modern world: materials of the All-Russian scientific-practical conference, 22-23 Apr. 2016, Chelyabinsk / ed. S. A. Yarushina, V. D. Ivanova. Chelyabinsk: Publishing house of the Chelyabinsk State University, pp.16-21. (in Russian)
- Silva, D. A. S., Chaput, J. P., & Tremblay, M. S. (2019). Participation frequency in physical education classes and physical activity and sitting time in Brazilian adolescents. *PLoS ONE*, 14(3), 1–14. DOI: [10.1371/journal.pone.0213785](https://doi.org/10.1371/journal.pone.0213785)
- Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G., & Joshi, G. (2020). Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. *Psychiatry Research*, 293, 113429.
- Slepchenko, A.L., Krasnov, V.V., & Volsky, R.K. (2019). Motivation as a component of physical education. *Young Scientist*, 19 (257), 388-390. (in Russian)
- Svyatova, N.V., Urbanov, A. Yu., Miftakhov, S.F., Abdulin, I.F. (2018). Functionality of an organism of students in connection with occupations the physical activities aimed at the development of endurance. *Modern Problem Sciences and Education*, 1. <http://science-education.ru/ru/article/view?id=27396> (in Russian)
- Tomás Reyes-Amigo, Javier Saa Molina, Gonzalo Martinez Mera, Josivaldo De Souza Lima, Jessica Ibarra Mora, Johana Soto-Sánchez (2021). Contribution of high and moderate-intensity physical education classes to the daily physical activity level in children. *Journal of Physical Education and Sport*, Vol. 21 (1), Art 4, pp. 29 - 35, January 2021. DOI: [10.7752/jpes.2021.01004](https://doi.org/10.7752/jpes.2021.01004)
- Tortella, P., Cecilian, A., Fumagalli, G., Jidovtseff, B., Wainwright, N., Fjortoft, I., Sigmundsson, H., Haga, M., Sgrò, F., Lipoma, M., Sääkslahti, A. (2021). Children’s outdoor movement education: position statement. *Journal of Physical Education and Sport*, Vol 21 (Supplement issue 1), Art 46 pp 451 – 462, Feb.2021. DOI: [10.7752/jpes.2021.s1046](https://doi.org/10.7752/jpes.2021.s1046)
- W.H.O. (2020). WHO Guidelines on physical activity and sedentary behavior: web annex evidence profiles Available from: <https://www.who.int/publications/i/item/9789240015111>
- Wojciech Marynowski, Małgorzata Wojciechowska, Anita Trojanowska, Agnieszka Cudnoch-Jędrzejewska (2021). Physical activity as a non-pharmacological method for reducing systemic inflammation. *Journal of Physical Education and Sport*, Vol. 21 (1), Art 14, pp. 101 - 109, January 2021. DOI: [10.7752/jpes.2021.01014](https://doi.org/10.7752/jpes.2021.01014)
- Zorio-Ferreres, A., Alguacil, M. Y García-Pascual, F. (2018). Analysis of the opinion on physical education in high schools and the extracurricular sports practice of students and their personal environment. *Journal of Physical Education and Sport*, 18(3), Art 241, pp.1646 - 1653, DOI: [10.7752/jpes.2018.03241](https://doi.org/10.7752/jpes.2018.03241)