



T&PPC

№ 7 July 2026

Theory & Practice of Physical Culture

**Athletic
training**

**Sport
psychology**

**Academic
physical education**

**Sport
physiology**

7'2026

Monthly Scientific-theoretical
Journal, founded in 2013

ISSN 2409-4234

CHIEF EDITOR
Lubysheva L.I.

EDITORIAL BOARD:

Lubysheva L.I.
Doctor of Pedagogical Sciences, Professor
Ashkinazi S.M.
Doctor of Pedagogical Sciences, Professor
Gorelov A.A.
Doctor of Pedagogical Sciences, Professor
Peshkova N.
Doctor of Pedagogical Sciences, Associate
Professor
Rumba O.G.
Doctor of Pedagogical Sciences, Professor
Bulgakova N.Z.
Doctor of Pedagogical Sciences, Professor
Gundegmaa Lhagvasuren
Doctor of Biological Sciences, Professor
Popov G.I.
Doctor of Pedagogical Sciences, Professor
Vrublevsky E.P. Doctor of Pedagogical
Sciences, Professor
Zagrevsky V.I.
Doctor of Pedagogical Sciences, Professor
Sivokhin I.P.
Doctor of Pedagogical Sciences, Professor
Manolaki V.G.
Doctor of Pedagogy, Professor
Manolaki V.V.
Doctor of Pedagogy, Professor
Lednicki A.
Candidate of pedagogical Sciences,
associate professor
Zagrevskaya A.I.
Doctor of Pedagogical Sciences, Professor
Tambovtseva R.V.
Doctor of Pedagogical Sciences, Professor
Zakharieva N.N.
Doctor of Medical Sciences, Professor
Neverkovich S.D.
Academician of the Russian Academy
of Education, Doctor of Pedagogical
Sciences, Professor
Manzheley I.V.
Doctor of Pedagogical Sciences, Professor
Rumba O.E.
Doctor of Pedagogical Sciences, Professor
Altantsetseg Lhagwasuren
Doctor of Pedagogical Sciences

©ANO SPC «Theory
and Practice of Physical
Culture and Sport»

105122 Moscow,
Sirenevsky blvd, 4.
e-mail: fizkult@teoriya.ru

<http://www.tpfk.ru>



Theory and Practice
of Physical Culture

Theory and Practice of Physical Culture

Contents

THEORY AND METHODOLOGY OF SPORT

S.V. Sevdalev, E.P. Vrublevskiy – Individualization of athletes' training in modern pentathlon, adapted to the conditions modifications to the competitive structure	3
Liu Suyu, M.S. Kozhedub, E.P. Vrublevskiy, Je Su – The dynamics of speed and strength indicators in runners for different distances, depending on the biorhythms of their body.....	7
O.E. Ponimasov – Improving the mechanisms of energy supply for the speed capabilities of young sprinter swimmers.....	11
I.P. Sivokhin, N.A. Ogienko, A.V. Andreychik, D.E. Zhumekenova – Management of speed-strength preparation in handball as a factor in the effective realisation of competitive activity	14
N.A. Fedyaev, I.S.-Kh. Musaev, A.L. Insarov – Interrelation of the psychophysiological parameters of sambo wrestlers with the results of competitive activity.....	18
E.V. Markin – Powerlifting as an example of a socio-pedagogical system in strength sports	21
E.S. Sivukhina, V.V. Ponomarev, N.A. Kozhura – Analysis of the dynamics of injuries to the musculoskeletal system of track-and-field athletes at the stage of sports specialisation in the annual cycle: a theoretical aspect.....	25
D.V. Sorokin – Development of physical qualities in track-and-field runners at the stage of the improvement of sporting mastery	28
A.A. Soparev – Training devices as a tool for the individualisation and for increasing the density of technical preparation in student volleyball	32
Feiyi Zhang, Xuesong Bai, M.S. Kozhedub, Pan Yuanquan, E.P. Vrublevskiy – Targeted impact on kinematic parameters as a factor in improving the athletic skills of young short-distance runners.....	36
L.I. Lubysheva, A.V. Belyaev – The effectiveness of the use of figurative And model didactic tools in technical training of young hockey players	40

SPORT PSYCHOLOGY

A.E. Lovyagina, E.A. Gurvich, V.M. Sheloumova – Values, mental skills and competitive reliability in athletes with different levels of hardness	44
--	----

PROFESSIONAL-APPLIED PHYSICAL CULTURE

Yu.V. Smirnova, E.G. Saykina, V.E. Smirnov, P.V. Stankevich – The use of crossfit in the system of physical training of special unit personnel.....	47
V.V. Ponomarev, E.M. Kadomtseva, T.V. Fateeva, V.V. Grigoriev – Developing applied life safety skills in students during physical education at the university.....	50

MOTOR ACTIVITY OF THE POPULATION

D.V. Zharova, L.V. Skitnevskaya, E.M. Kochneva, N.N. Kuimova – The relationship between subjective well-being and involvement in physical activity and sport among the residents of the Nizhny Novgorod Region	52
Zhu Qiuhan, Yang Yuzhou, Ma Kehan, V.S. Makeeva – Improving the physical literacy of pupils aged 10–11 on the basis of the Chinese Healthy Physical Education Curriculum Model	55
T.I. Melnikova, L.V. Morozova, O.P. Vinogradova – Social and organisational factors of students' mastery of swimming skills	59

ADAPTIVE PHYSICAL CULTURE

A.O. Egorychev, E.V. Egorycheva, D.I. Priimenko, A.V. Priimenko – Functional approach to the organisation of classes in a special educational department	62
---	----

IN SEARCH OF A NEW BREAKTHROUGH

O.E. Ponimasov, S.V. Solomatin – Areas of the social integration of young athletes based on a study of the opinions of sports educators.....	67
E.N. Skarzhinskaya, A.V. Ermakov, V.A. Beresneva, M.A. Novoselov – The use of artificial intelligence at the stages of sports preparation.....	70
A.M. Fokin – Resource potential of the active-game educational environment of physical education	74

FROM EDITOR'S PAPERCASE

L.A. Parfenova, E.V. Burtseva, R.R. Giniyatullin – Methods for evaluating the effectiveness of sports and correctional activities for children with intellectual disabilities	77
E.A. Gibulin, L.A. Parfenova – Effectiveness of a powerchair football training methodology for individuals with musculoskeletal impairments	79



Individualization of athletes' training in modern pentathlon, adapted to the conditions modifications to the competitive structure

UDC 796.093.645



PhD, Associate Professor **S.V. Sevdalev**¹

Dr. Hab., Professor **E.P. Vrublevskiy**¹

¹Francysk Skaryna Gomel State University, Gomel

Corresponding author: vru-evg@yandex.ru

Received by the editorial office on 17.02.2026

Abstract

Objective of the study is to develop and verify a concept of the individualisation of the preparation of elite female athletes specialising in modern pentathlon.

Methods and structure of the study. The research was carried out at the laboratory of Olympic sports of Skorina Gomel State University. Personalised models of the preparation of pentathletes were drawn up and trialled in the training process of six highly qualified female athletes (Master of Sport – International Master of Sport). The productivity of the models was assessed by the magnitude of the significant improvement in the physical and functional preparedness of the athletes and by the gain in sporting results in the disciplines of the pentathlon.

Results and conclusions. A concept of the individualisation of the training process of female athletes in modern pentathlon has been developed which includes personalised models of competitive activity, of the construction of the annual cycle of preparation and of the projected dynamics of the level of special preparedness of the particular pentathlete, oriented towards attaining the planned values by the time of the main competitions. The practical application of the models developed, which are based on taking account of the individual characteristics of competitive activity and of the morphofunctional and biorhythmological features of the body of the particular athlete, contributed to a significant increase in her level of preparedness, to a gain in sporting results in the disciplines of modern pentathlon, and to a successful performance at the major national and international competitions of the 2024-2025 season.

Keywords: *concept of individualisation, female athletes, competitive activity, preparation, pentathlon.*

Introduction. Modern pentathlon is one of the most complex and dynamically developing multi-event sports. Traditionally, Russian and Belarusian female athletes are among the strongest in the world. With the aim of increasing spectator appeal, social attractiveness, economic efficiency and animal protection, the International Modern Pentathlon Union (IMPU) changed the competition rules. Equestrian sport (show jumping) was excluded from modern pentathlon and a new event appeared – one involving the negotiation of an obstacle course (obstacle race) – which altered the format of the competitions. In this connection, specialists need to modernise the classical approaches to planning the training process of pentathletes.

Objective of the study is to develop and verify a concept of the individualisation of the preparation of

elite female athletes specialising in modern pentathlon.

Methods and structure of the study. The research was carried out at the laboratory of Olympic sports of Skorina Gomel State University. Personalised models of the preparation of pentathletes were developed and trialled in the training process of six highly qualified female athletes (Master of Sport – International Master of Sport). The productivity of the models was assessed by the magnitude of the significant improvement in the physical and functional preparedness of the athletes and by the gain in sporting results in the disciplines of the pentathlon.

Results of the study and discussion. The concept of the individualisation of the preparation of female athletes presupposes the development of



personalised models of competitive activity, of the structure of the construction of the annual cycle of preparation, and of the projected dynamics of the level of special preparedness [3, 4].

Previously, the authors identified two types of group models of competitive activity in modern pentathlon [5]; however, following the change in the competition rules (based on the results of the 2024-25 competitive season) three principal types of group models may now be distinguished. The first type (38.5 %) brings together athletes demonstrating excellent indicators in the combined event of modern pentathlon; the second (23.1 %) includes athletes showing first-class achievements in the combined relay and in the nego-

tiation of the obstacle course; and the third (19.2 %) consists of athletes with high results in fencing and in the negotiation of the obstacle course. Within the framework of the research, each pentathlete taking part in the experiment was assigned the group model that best corresponded to her individual characteristics of competitive activity.

The model of the structure of the annual cycle of preparation was constructed on the basis of the traditional theoretical and methodological approaches to planning the training process and with account taken of the features of the calendar of forthcoming competitions [1, 2, 4]. The practical realisation of the model developed presupposed a common approach

Table. Model of the individualisation of the construction of the preparation of a female athlete (second macro-cycle of the annual cycle)

Macrocycle		II										Volume of load per macrocycle, km, h
Periods		Preparatory			Competition					Transit.		
Stages		General preparatory	Special preparatory	Stage of the main competitions								
Mesocycles				B	CP	PC	C	I	CP		PC	
Months Means of preparation		III	IV		V	VI		VII	VIII		IX	
Aerobic recovery focus	Running, km, %	58.3	155.8		380.5					594.6		
		9.8	26.2		64.0					100		
	Swimming, km, %	7.0	6.8		21.1					34.9		
		20.1	19.5		60.4					100		
Aerobic development focus	Running, km, %	114.0	104.5		281.6					500.2		
		22.8	20.9		56.3					100		
	Swimming, km, %	12.3	20.2		49.9					82.3		
		14.9	24.5		60.6					100		
Mixed aerobic-anaerobic focus	Running, km, %	13.0	13.0		28.2					54.2		
		24.0	24.0		52.0					100		
	Swimming, km, %	6.2	9.3		26.8					41.1		
		15.0	22.7		65.3					100		
Glycolytic anaerobic focus	Running, km, %	3.5	1.5		19.2					24.2		
		14.4	6.3		79.3					100		
	Swimming, km, %	2.2	2.1		11.9					16.2		
		13.3	13.0		73.7					100		
Mixed alactic-glycolytic focus	Running, km, %	–	0.6		22.8					23.4		
			2.4		97.6					100		
	Swimming, km, %	0.8	5.4		4.6					10.8		
		7.0	50.2		42.8					100		
Fencing (combat practice, lessons and work in pairs), h, %		24.0	16.0		38.0					78.0		
		30.8	20.5		48.7					100		
Obstacle course (specialised training), h, %		12.0	28.0		36.0					76.0		
		15.8	36.8		47.4					100		
Shooting (specialised training), h, %		30.0	21.0		26.0					77.0		
		38.9	27.3		33.8					100		
General physical preparation (sets of jumping, special and isometric exercises). h, %		12.0	20.0		18.0					50.0		
		24.0	40.0		36.0					100		

Note: I – introductory, B – base, CP – control-preparatory, PC – pre-competition, C – competition, R – recovery mesocycle.



to the distribution of loads across macro- and mesocycles for the whole group of athletes taking part in the experiment. At the same time, the volume and intensity of the load were determined individually, proceeding from the morphological, psychological and biorhythmological features, the level of physical and functional preparedness, and the model of competitive activity of the particular athlete.

The structure of the annual cycle of preparation developed provided for two consecutively realised macrocycles. The first included a preparatory period consisting of three mesocycles of the general preparatory stage and two mesocycles of the special preparatory stage, as well as competition and transition periods (one mesocycle each). The second macrocycle combined one mesocycle of the general preparatory stage and two mesocycles of the special preparatory stage, as well as competition (five mesocycles) and transition (one mesocycle) periods.

The construction of the macrocycles of preparation was based on a rational combination of the principal training means and on the optimal distribution of their volumes, with account taken of the parameters attained and recorded in the preceding annual cycle. In the course of the observations, individual changes in the indicators of the athletes' special preparedness were recorded, depending on the content, volume and intensity of the training load and on the influence of the phases of the biorhythmological cycle of the particular athlete.

The training process included a wide range of means of preparation: running of various intensities (at a speed below and at the level of the anaerobic threshold – over distances from 800 to 2000 m – and at competition speed – from 200 to 1000 m), swimming over segments from 25 to 2000 m (depending on the stage of preparation), fencing (combat practice, individual lessons and work in pairs), shooting, and specialised training on the obstacle course. In addition, the sets of jumping, isometric and special physical exercises that had been developed were applied.

The model of the structure of the construction of the annual cycle of preparation of elite female athletes that was developed had previously been trialled in earlier competitive seasons, and the data obtained, reflecting the consistently high results of the participants, confirmed its effectiveness [3, 6]. On this basis, the organisational and methodological principles of its realisation were integrated as a key element into

the models of the individualisation of the preparation of particular athletes specialising in modern pentathlon. The Table presents such a model of the individualisation of the construction of preparation (using the example of one macrocycle of the annual cycle) for a leading Belarusian pentathlete (V.G.).

The concept proposed also provides for the construction of a model of the projected dynamics of the indicators of the special physical and functional preparedness and of the psychophysiological state of the particular athlete within each macrocycle of the annual cycle of preparation, oriented towards attaining the planned values by the time of the main competitions. This model includes the most informative indicators characterising special preparedness and having a high correlation with the competitive result: relative oxygen uptake at the level of the anaerobic threshold (VO_2 (AT)), running speed at the level of the anaerobic threshold (VHR), the 1000 m run, the 50 m swim, and simple visual-motor reaction (SVMR) [7].

The indicators specified served as a reference point for monitoring the effectiveness of the course of the training process by means of feedback, the function of which consisted in the regular assessment of the athlete's current state, the comparison of the actual values with the model values and, where necessary, the introduction of prompt adjustments to the programme of preparation.

The Figure presents a model of the projected dynamics of the most informative indicators characterising the special preparedness of one of the strongest pentathletes of Belarus (using the example of one macrocycle).

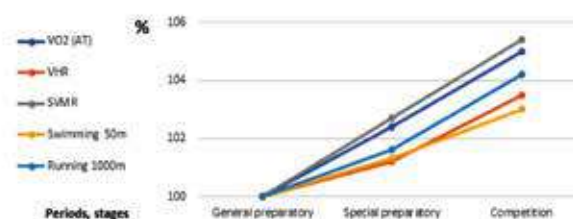


Figure. Individual model of the projected dynamics of the level of special physical, functional and psychophysiological preparedness of the female athlete V.G.

The level of physical preparedness was assessed once a month, whereas the monitoring of functional preparedness was carried out once at each stage of the annual cycle of preparation, which is connected



with the complexity of the measurements (in particular, the use of a gas analyser). The practical role of the model developed consisted in the fact that it acted as the methodological basis for the individualisation of the training process of the particular athlete.

The experimental verification of the effectiveness of the models of the individualisation of the preparation of elite female athletes was carried out under the conditions of their training process in 2024-2025. On completion of the annual cycle of preparation, a comparative analysis was conducted of the competitive results shown by the athletes at the major international competitions.

A statistically significant improvement was revealed in the results in the combined relay, in the negotiation of the obstacle course and in the overall pentathlon score ($p < 0.05$). In swimming and fencing a pronounced positive trend was recorded, close to the level of statistical significance.

In addition, the content implemented and the differentiated distribution of the training influences ensured a statistically significant ($p < 0.05$) improvement in physical and functional preparedness in the majority of the indicators studied (VO_2 (AT), VHR, the 1000 m run, the 50 m swim).

Conclusions. A concept of the individualisation of the training process of female athletes in modern pentathlon, adapted to the conditions of the transformation of the competition structure of the sport, has been developed and experimentally substantiated. It was established that the realisation of models based on taking account of the individual characteristics of competitive activity, of the morphofunctional and biorhythmological features of the athletes' bodies, and of the differentiated planning of the load within the structure of the annual cycle of preparation ensures an increase in the effectiveness of the training process without an increase in the total volumes and intensity of the training influences.

The practical effectiveness of the approach proposed is confirmed by the steady growth of sporting

results and by the successful performance of the athletes at the international competitions of the 2024-2025 season, including the World Cup stages and the final of the «Pavel Lednev Cup».

References

1. Lagoyda V.G. Osnovy mnogoletney podgotovki v sovremennom pyatiborye. Ufa: Izd. Bashgosuniversiteta, 1996. 132 p.
2. Matveev L.P. Obshchaya teoriya sporta i ee prikladnye aspekty: uchebnik dlya vuzov. 6th ed. Moskva: Sport, 2019. 340 p.
3. Platonov V.N. Periodizatsiya sportivnoy trenirovki. Obshchaya teoriya i ee prakticheskoe primeneniye. Kiev: Olimpiyskaya literatura, 2013. 624 p.
4. Sevdalev S.V., Borovaya V.A., Netsvetaeva E.S., Vrublevskiy E.P. Organizatsiya makrotsikla podgotovki vysokokvalifitsirovannykh sportsmenok, spetsializiruyushchikhsya v sovremennom pyatiborye. Teoriya i praktika fizicheskoy kultury. 2023. No. 9. Pp. 94-96.
5. Sevdalev S.V., Vrublevskiy E.P., Narskin G.I. Individualnye osobennosti struktury sorevnovatelnoy deyatel'nosti vysokokvalifitsirovannykh sportsmenok, spetsializiruyushchikhsya v sovremennom pyatiborye. Chelovek. Sport. Meditsina. 2023. V. 23. No. 2. Pp. 150-158.
6. Sevdalev S.V., Borovaya V.A., Vrublevskiy E.P. Algoritm individualizatsii trenirovochnogo protsessa kvalifitsirovannykh sportsmenok, spetsializiruyushchikhsya v sovremennom pyatiborye, v godichnom tsikle podgotovki. Teoriya i praktika fizicheskoy kultury. 2024. No. 7. Pp. 33-35.
7. Sevdalev S.V. Otsenka fizicheskoy i funktsionalnoy podgotovlennosti vysokokvalifitsirovannykh sportsmenok v sovremennom pyatiborye. Prikladnaya sportivnaya nauka. 2025. No. 1(21). Pp. 61-67.



The dynamics of speed and strength indicators in runners for different distances, depending on the biorhythmics of their body

UDC 796.051.2



Postgraduate student **Liu Suyu**¹

M.S. Kozhedub¹

Dr. Hab., Professor **E.P. Vrublevskiy**¹

Postgraduate student **Je Su**²

¹Francysk Skaryna Gomel State University, Gomel

²Polesky State University, Pinsk

Corresponding author: vru-evg@yandex.ru

Received by the editorial office on 19.03.2026

Abstract

Objective of the study is to identify the nature of the orientation of training effects depending on the biorhythmological features of the body of qualified female sprinters and middle-distance runners.

Methods and structure of the study. The study involved female track-and-field athletes (n=24) aged 16–18 years specialising in short-distance (n=12) and middle-distance (n=12) running and holding the qualifications of First Sports Category to Candidate for Master of Sport. An analysis was made of the individual duration of the biological cycle, together with a comparison of the data of testing speed and speed-strength abilities in the various phases of the ovarian-menstrual cycle (OMC) over the course of the annual macrocycle of preparation.

Results and conclusions. It was established that the dynamics of the speed-strength indicators of female runners vary substantially depending on the phase of the OMC and on the specialisation of the athletes. Individual differences in the duration of their biological cycle were determined, which conditions the number of days with high working capacity over the course of the annual cycle of preparation. Three types of reaction of the athletes to the phases of the OMC were identified, differing in the degree of decline of working capacity in the unfavourable phases. The need to individualise the training process with account taken of the phases of the OMC and of the specialisation of the runners is demonstrated.

Keywords: female sprinters and middle-distance runners, OMC, speed-strength abilities, training process, individualisation.

Introduction. The problem of rationalising sports training, the aim of which is the attainment of a planned level of preparedness within specific time limits, brings to the fore the study of the practical experience of constructing training sessions and the detailed analysis of the dependence of the dynamics of the athlete's state on the volume and orientation of the training load performed [1, 7].

At the same time, the course of the training process of female athletes is particularly influenced by the specific biological cycle, which is accompanied by a whole series of morphological, physiological and psychological changes in their bodies. It is precisely for this reason that an individual approach, ensuring the optimal level of preparedness of the particular athlete with account taken of her biorhythmological features, should constitute an important aspect of the effective

planning of the preparation programme of qualified female athletes [1, 3, 6].

In the opinion of a number of researchers, excessive training effects may contribute to overtraining in women to a considerably greater degree than in men [2, 4, 9]. This assumption determines the need to standardise loads that are adequate to the operational and current state of the female body in order to prevent the breakdown of adaptive processes. This fact acquires particular significance in the preparation of female sprinters and middle-distance runners, where high demands are placed both on speed-strength abilities and on special endurance.

Objective of the study is to identify the nature of the orientation of training effects depending on the biorhythmological features of the body of qualified female sprinters and middle-distance runners.



Methods and structure of the study. The study involved female track-and-field athletes aged 16 to 18 years ($n=24$) specialising in short-distance (100 m, 200 m, $n=12$) and middle-distance (800 m, 1500 m, $n=12$) running. The athletes held the qualifications of First Sports Category (15 persons) and Candidate for Master of Sport (9 persons).

On the basis of an analysis of the duration of the athletes' biological cycle and a comparison of the testing data in the various phases of the OMC, the dynamics of their speed-strength indicators were studied. In accordance with the generally accepted classification [8], the OMC was divided into five phases: the menstrual phase, lasting 3–5 days; the postmenstrual phase, 6–9 days; the ovulatory phase, 4 days; the postovulatory phase, 6–9 days; and the premenstrual phase, 3–5 days.

The 30 m run from a flying start was used to determine the level of speed abilities. Speed-strength abilities were assessed by means of the standing long jump and the standing triple jump, as well as throws of a 4 kg shot forwards from below and backwards overhead. The testing was carried out in each of the five phases of the OMC throughout the whole annual cycle of preparation.

Results of the study and discussion. An analysis of the duration of the biological cycle in the female track-and-field athletes examined showed that, depending on this parameter, they may be divided into three groups (Table 1).

It is evident that the shorter the OMC in young female athletes, the smaller the number of days characterised by good and high working capacity. As may be seen from the data presented in the table, the athletes with the longest OMC represent the most effective biological model for the realisation of training plans: on average, they have 228 days with high working capacity per year, which fall within the most 'favourable' phases of the OMC. In runners with a 25–28-day cycle this indicator amounts to 210 days, and in athletes with a 21–24-day cycle to only 192 days. Consequently, when planning the macrocycle it is necessary to take into account not only the phase structure of the OMC but also its overall duration, since the number of days favourable for the performance of high-intensity loads depends on this.

A comparison of the testing data made it possible to identify differences in the dynamics of the speed and speed-strength indicators of runners with different durations of the biological cycle. Although the differences identified did not reach the level of statistical significance ($p>0.05$), a tendency may be traced: athletes with a longer OMC demonstrate a greater gain in speed and speed-strength indicators over the annual macrocycle of preparation. Thus, in runners with a 29–32-day cycle the gain in results in the tests analysed amounted on average to 9.2 %, and in athletes with a 25–28-day cycle to 8.0 %. The athletes with the shortest duration of the cycle increased their indicators by 6.3 %.

Table 1. Distribution of the female runners by the duration of the OMC over the annual macrocycle

Duration of the OMC	Number of athletes	%	Average number of mesocycles per year	Average number of days with high working capacity
21-24 days	6	25.0	16	192
25-28 days	14	58.3	14	210
29-32 days	4	16.7	12	228

Table 2. Distribution of the types of reaction to the phases of the OMC in female runners of different specialisations

Type of reaction	Characteristics	Sprinters	Middle-distance runners
Type I	Sharp deterioration in well-being and working capacity in phases I and V, decline in results in all the tests	6 (50.0 %)	8 (66.7 %)
Type II	Insignificant change in the indicators in phases I and V, preservation of working capacity	4 (33.3 %)	3 (25.0 %)
Type III	High working capacity throughout the whole cycle, minimal fluctuations	2 (16.7 %)	1 (8.3 %)



In the course of comparing the dynamics of the athletes' motor abilities across the phases of the OMC, three types of reaction were distinguished, which were differently distributed among the sprinters and the middle-distance runners (Table 2).

As may be seen from the table, the middle-distance runners proved to be more sensitive to the unfavourable phases of the cycle: 66.7 % of them were assigned to type I, characterised by a sharp deterioration in well-being and working capacity in the menstrual and premenstrual phases. Among the sprinters, the proportion of athletes with a type I reaction amounted to 50.0 %.

The data obtained are consistent with the results of the research of a number of authors [1, 3, 5, 8, 9, 10], showing that the dynamics of the motor capabilities of female athletes over the course of the OMC are wave-like in character. Our observations also confirm that in the menstrual and premenstrual phases the level of the speed and speed-strength abilities of female runners is minimal, whereas in the postmenstrual and postovulatory phases it is at its highest.

The more pronounced deterioration of the indicators in middle-distance runners may be connected with a number of factors. Thus, the specific nature of their preparation implies a greater total volume of training loads, which leads to the accumulation of fatigue. Alongside this, the dominant orientation of the training process of middle-distance runners places increased demands on the aerobic systems of energy supply, which are distinguished by an increased sensitivity to hormonal fluctuations.

The earlier data of our research, conducted on high-class female runners, showed [1, 5] that speed abilities are manifested to a greater degree in the postovulatory phase and that the improvement of the result in the 30 m run from a flying start occurs through an increase in the frequency of the running strides. As regards speed endurance, the dynamics of the speed indicators in the 150 m run at the stages of the annual cycle and in the various phases of the OMC indicate the predominant manifestation of this ability in the postmenstrual phase. The improvement of the result here is connected with the capacity to produce a greater length of running stride and to maintain it optimally to the end of the distance.

At the same time, account should be taken of the fact that a characteristic feature of one or another duration of the OMC is the differing duration of the first

half of the cycle (up to ovulation) and the identical duration of the second half (from ovulation to menstruation) [8, 10, 11]. Thus, the longer the athlete's OMC, the greater the preconditions for realising the programme of developing special endurance. At the same time, in athletes with a short duration of the OMC the tasks of increasing speed endurance have to be realised in a phase that is not the most favourable for this. In addition, this creates difficulties in the interrelations of the development of particular motor abilities (for example, maximum speed and speed endurance).

Thus, in the postovulatory phase fewer conditions are created for raising the level of speed endurance, and its purposeful development is better carried out in the postmenstrual phase. As regards speed capabilities, it is preferable to improve them in the postovulatory phase of the OMC. This must be taken into account when planning the training process, focusing attention on the individual features of the manifestation of one or another motor ability in the most favourable phase of the specific female cycle.

Conclusions. It was established that the dynamics of the speed and speed-strength indicators of female sprinters and middle-distance runners vary substantially depending both on one or another phase of the OMC and, in general, on the individual duration of the cycle itself, which determines the number of days with high working capacity per year.

Three types of reaction of the athletes to the phases of the OMC were identified, differing in the degree of decline of working capacity in the unfavourable phases. Middle-distance runners belong more often to the first type, characterised by a sharp deterioration in well-being and a decline in results in the menstrual and premenstrual phases, in comparison with sprinters. At the same time, in the postovulatory phase of the OMC it is better to place the emphasis in the training effects on raising the speed and speed-strength indicators, and in the postmenstrual phase to perform work connected with the development of special endurance.

Thus, the coach faces the task not only of taking into account the volume and orientation of the training load in the various phases of the OMC, but also of knowing its individual duration in one or another of his athletes, which will make it possible to determine the so-called 'favourable' and 'unfavourable' periods for the performance of large specific motor loads of a particular orientation.



References

1. Vrublevskiy E.P. Individualizatsiya trenirovochnogo protsessa sportsmenok v skorostno-silovykh vidakh legkoy atletiki. Moskva: Sovetskiy sport, 2009. 232 p.
2. Ivanov V.D., Rotor K.S. Zhenshchiny i sport: feminizatsiya sporta. Aktualnye problemy pedagogiki i psikhologii. 2021. V. 2. No. 1. Pp. 17-26.
3. Sevdalev S.V., Kozhedub M.S., Vrublevskiy E.P., Mitusova E.D. Individualizatsiya trenirovochnogo protsessa legkoatletok, spetsializiruyushchikhsya v bege na raznye distantsii, na osnove ucheta bioritmiki ikh organizma. Teoriya i praktika fizicheskoy kultury. 2020. No. 5. Pp. 83-85.
4. Kalinina N.A. Giperandrogennyye narusheniya reproduktivnoy sistemy u sportsmenok: avtoref. dis. ... d-ra med. nauk. Moskva, 2004. 46 p.
5. Kostyuchenko V.F., Vrublevskiy E.P., Kozhedub M.S. Vliyaniye bioritmiki organizma kvalifitsirovannykh sportsmenok na dinamiku ikh dvigatelnykh sposobnostey. Uchenye zapiski universiteta imeni P.F. Lesgafta. 2018. No. 4. Pp. 159-164.
6. Nikitushkin V.G. Zhenskiy sport: uchebnik dlya vuzov. Moskva: Izdatelstvo Yurayt, 2022. 277 p.
7. Platonov V.P. Sistema podgotovki sportsmenov v olimpiyskom sporte. Obshchaya teoriya i ee prakticheskiye prilozheniya. Kiev: Olimpiyskaya literatura, 2004. 808 p.
8. Pokholenchuk Yu.T., Svechnikova N.V. Sovremennyy zhenskiy sport. Kiev: Zdorovya, 1987. 191 p.
9. Shakhlina L.Ya.-G. Mediko-biologicheskiye osnovy sportivnoy trenirovki zhenshchin. Kiev: Naukova dumka, 2001. 326 p.
10. Wajewski A. Poznawcze i metodyczne problemy sportu kobiet. Warszawa: AWF, 2009. Pp. 80-87.
11. Women in the track and field. New Studies in Athletes. 2005. No. 7. Pp. 61-66.



Improving the mechanisms of energy supply for the speed capabilities of young sprinter swimmers

UDC 797.21



Dr. Hab., Professor **O.E. Ponimasov**^{1, 2}

¹The Russian Presidential Academy of National Economy and Public Administration, Moscow

²The Herzen State Pedagogical University of Russia, Saint Petersburg

Corresponding author: o-pony@mail.ru

Received by the editorial office on 17.02.2026

Abstract

Objective of the study is to examine the influence of alactate, glycolytic, and aerobic energy production mechanisms on the performance level of young swimmers in short-distance swimming.

Methods and structure of the study. In a test with a stepwise increase in load and a rotation speed of 70 rpm when working with the arms and 60 rpm when working with the legs, indicators of average and maximum power were measured. Correlation coefficients were calculated between swimming speed and anaerobic and aerobic capabilities.

Results of the study and conclusions. It has been established that the activating stimuli of speed-strength exercises aimed at developing maximum power in arm and leg work ensure a deepening of adaptive changes in the swimmers' bodies.

Keywords: *sprinter swimmers, energy supply mechanisms, speed abilities.*

Introduction. The systematic monitoring of physical working capacity indicators makes it possible to introduce appropriate adjustments into the training process with a view to achieving the highest sporting results.

The energy supply of muscular activity in sport is based on three principal sources of energy production. The anaerobic alactic mode of energy reproduction is characterised by the breakdown of creatine phosphate (CP) in the mitochondria. The anaerobic lactic mode of energy supply involves the catabolism of carbohydrates, predominantly muscle glycogen. The aerobic metabolic process involves the breakdown of carbohydrates, free fatty acids and, in part, proteins [2].

Taken together, all three modes ensure the resynthesis of ATP, the formation of adenosine-5-triphosphate, and reach their peak in the presence of creatine phosphate. The biochemical processes described enable the skeletal muscles to develop force rapidly when exposed to physical loading [6].

The mechanisms of the phosphagen energy supply of swimmers' working capacity have been insufficiently studied. A statistically significant relationship has been established between the explosive strength of the legs and the effectiveness of sprint swimmers both when performing the start and when covering the distance [1, 5].

A high level of anaerobic glycolytic energy supply determines the effectiveness of stroke efforts over a period of several tens of seconds [2].

Maximum oxygen uptake determines the working capacity of swimmers specialising in short-distance swimming lasting approximately 60 s. In the 60-second test assessing anaerobic capacity, oxygen uptake during the final 30 s of physical loading amounts to 90.5-92 % of O_{2max} [3].

There are various methods of measuring O_{2max} . Most frequently a gradual increase in intensity is used, and less often continuous or interval loads. Owing to the specific nature of swimming, the testing of swimmers on ergometers is usually carried out under labo-



ratory conditions. In flumes such tests are performed in a water flow, and in the pool 'tethered swimming' is used [4].

Objective of the study is to examine the influence of energy performance on the swimming speed of young sprint swimmers.

Methods and structure of the study. The indicators of 32 sprint swimmers aged 14.5 ± 0.9 years were studied. Each participant performed five laboratory tests and two swimming tests: a vertical jump; a test of the aerobic endurance of the arm and leg muscles with progressive loading; a one-minute test of the anaerobic endurance of the arm and leg muscles; a 50 m swim; and a 100 m swim.

The arm tests for O_{2max} were performed in a seated position on an 884-Ergonomic cycle ergometer. The test of the aerobic working capacity of the legs (O_{2max}) was performed on an ER 900 Jaeger cycle ergometer. The resistance of the ergometer was set for each participant at 7.5 % of maximum in the leg muscle tests and at 4.5 % of maximum in the arm muscle tests. The tests were preceded by a 5-minute warm-up.

The intensity of the O_{2max} test during arm work ranged from 60 to 90 W depending on the age and endurance of the swimmer and was increased every three minutes by 12 or 18 W.

The indicators of average and maximum power were determined in the anaerobic endurance test using the upper and lower limbs, and were measured in the test with stepwise increasing loading at a rotation speed of 70 rpm during arm work and 60 rpm during leg work. Gas exchange indicators were calculated using a 919ER MEDIKRO device as the mean values of maximum oxygen uptake (O_{2max}) over a 15-second period of work.

In order to determine the lactate concentration by means of a Lactate Plus (Sport) analyser, blood was sampled from the finger three minutes after the anaerobic and swimming tests had been performed.

The maximum power and workload in a single verti-

cal jump were recorded using an Opto Jump Next device. The displacement of the centre of gravity during the vertical jump was assessed by the duration of the jump.

In order to determine the relationship between swimming speed and anaerobic and aerobic capacity, partial correlation coefficients were calculated. All tests were carried out using the STATISTICA 12 software package.

Results of the study and discussion. The principal statistical characteristics of the energy indicators are presented in Tables 1 and 2.

The average power developed by the arms and legs is highly related to swimming speed over 50 and 100 m, whereas maximum power correlates with these indicators to a lesser degree. The maximum power during the work of the lower limbs and the total work in the vertical jump test exerted a strong influence on swimming speed over 50 and 100 m. All the above indicators of physical endurance correlated significantly with the index of arm movement coordination in the 50 m swim. Moreover, a significant moderate relationship was observed between O_{2max} in the tests of upper and lower limb work and swimming speed over 50 and 100 m.

After the anaerobic load during arm work the blood lactate concentration averaged approximately 12.6 ± 1.73 mmol/l, and in the test involving leg work – 14.1 ± 1.46 mmol/l. At the 3rd minute of recovery after the 100 m swimming test the blood lactate concentration was 12.2 ± 1.89 mmol/l and was statistically significantly higher than after the 50 m swimming test – 7.8 ± 1.96 mmol/l.

In sprint swimming the swimmer's speed of progression depends chiefly on the effectiveness of the anaerobic glycolytic mechanisms of the energy supply of muscular work, which is confirmed by the high correlation coefficients between the indicators of maximum power obtained in the one-minute anaerobic tests during arm and leg work and swimming speed over 50 and 100 m.

Table 1. Energy indicators of the swimmers

Parameter	P arms, W	Pmax arms, W	P legs, W
x $\pm$ SD	284.4 $\pm$ 55.6	349.9 $\pm$ 83.4	468.8 $\pm$ 76.7
Parameter	Pmax legs, W	O_{2max} arms, l/min	O_{2max} legs, l/min
x $\pm$ SD	655.3 $\pm$ 95.1	3.14 $\pm$ 0.54	3.82 $\pm$ 0.53

Note: O_{2max} – maximum oxygen uptake; P arms – average power output; P_{max}^* – maximum power output.



Table 2. Relationship between the energy indicators and swimming speed over 50 and 100 m

Indicator	V50	V100
Average power output of the arms	0.523	0.575
Maximum power output of the arms	0.465	0.445
Average power output of the legs	0.674	0.678
Maximum power output of the legs	0.859	0.734
Maximum oxygen uptake during arm work	0.365	0.465
Maximum oxygen uptake during leg work	0.543	0.528

A considerable contribution to the anaerobic mechanisms of energy supply under these conditions is made by the high concentration of lactate in the blood after training. In all the athletes examined it was highest after the 100 m front crawl swim. Taking the metabolic profile into account, it may be asserted that young sprint swimmers possess a high efficiency in the use of anaerobic energy. This is confirmed by the correlation of the swimming test results with the O_{2max} indicators during arm and leg work at a level of $r = 0.37$ to $r = 0.53$ ($p < 0.05$). The results in the 50 and 100 m swims are also linked by a high correlation with most of the indicators of anaerobic performance – the amount of work in the countermovement vertical jump and the maximum power output of the arms and legs ($r = 0.96$).

Conclusions. The results of the studies confirmed the significant influence of the alactic, glycolytic and aerobic mechanisms of energy production on the level of the results of young swimmers in short-distance swimming. The activating stimuli of speed-strength exercises aimed at developing the maximum power output of the arms and legs ensure a deepening of the adaptive shifts in the swimmers' bodies. The improvement of the anaerobic mechanisms of energy supply in sprint swimming is ensured by a high concentration of lactate in the blood after training in the water.

References

1. Bolotin A.E., Bakayev V., Ponimasov O.E., Vasylieva V. Peculiarities of respiratory functions in qualified swimmers exposed to multidirectional physical loads. *Journal of Human Sport and Exercise*. 2022. Vol. 17. No. 4. Pp. 860-866.
2. Bolotin A.E., Ponimasov O.E., Prigoda K.G., Vasylieva E.A. Faktory, vliyayushchiye na effektivnost vypolneniya starta v plavanii brassom [Factors affecting the efficiency of the start in breaststroke swimming]. *Teoriya i praktika fizicheskoy kultury*. 2023. No. 8. Pp. 86-88.
3. Kolganova E.Yu., Ponimasov O.E., Mironov A.O., Maryin I.S. Vremennyye kriterii i dinamika maksimalnogo potrebleniya kisloroda pri nepreryvnom i intervalnom plavanii s predelnoy aerobnoy skorostyu [Time criteria and dynamics of maximum oxygen consumption during continuous and interval swimming at maximum aerobic speed]. *Teoriya i praktika fizicheskoy kultury*. 2026. No. 4. Pp. 84-86.
4. Maryin I.S., Gridneva E.V., Fetisov V.N., Ponimasov O.E. Factors of the efficiency of swimming technique at the educational and training stage of young sprint swimmers [Factors affecting the effectiveness of swimming technique at the training stage of preparation for young sprinter swimmers]. *Teoriya i praktika fizicheskoy kultury*. 2026. No. 3. Pp. 93-95.
5. Ponimasov O.E. Faktory razvitiya skorostnykh sposobnostey yunikh plovtsov-sprinterov [Factors in the development of speed skills in young sprinter swimmers]. *Teoriya i praktika fizicheskoy kultury*. 2026. No. 2. Pp. 24-26.
6. Ponimasov O.E. Polifunktsionalnost gidrogennykh lokomotsiy kak dvigatelnykh substratov prikladnogo plavaniya [Polyfunctionality of hydrogenic locomotion as motor substrates of applied swimming]. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 4. Pp. 3-5.



Management of speed-strength preparation in handball as a factor in the effective realisation of competitive activity

UDC 796.323.322



Dr. Hab. **I.P. Sivokhin**¹

PhD **N.A. Ogienko**¹

A.V. Andreychik¹

D.E. Zhumekenova¹

¹A. Baitursynov Kostanay Regional University, Kostanay

Corresponding author: sivokhin_i_57@mail.ru

Received by the editorial office on 30.06.2026

Abstract

Objective of the study is to increase the effectiveness of the playing and competitive activity of an educational and training group of female handball players aged 13-14 years by developing an experimental programme for the use of speed-strength exercises, with account taken of the physiological mechanisms of adaptation.

Methods and structure of the study. The study was carried out at the Akhmet Baitursynov Kostanay Regional University; the practical part of the study was carried out at the Kadyrbek Ospanov Children's and Youth Sports School No. 1 of the city of Kostanay, with the involvement of female handball players aged 13-14 years in the groups of the second year of the educational and training stage. By means of a battery of tests, the physical state of the athletes was monitored and analysed; the effectiveness of playing and competitive activity was analysed by means of pedagogical observation; and the results were processed using mathematical and statistical methods.

Results and conclusions. It was established that the inclusion in the training process of exercises aimed at developing the fast muscle fibres and the explosive strength of the limbs makes it possible to develop the speed-strength condition of the body purposefully and to activate the adaptive capacities of the central nervous system, which are key to the performance of playing actions in handball. The improvement of these qualities contributes to the more effective performance of technical elements: throws, feints, sharp starts and changes of direction. The experimental programme using strength exercises in the intensity zone of 70-90 % of maximum strength enhanced the effectiveness of playing and competitive activity. Statistical analysis confirmed a significant gain in the indicators of the standing long jump, the vertical jump and the shuttle run ($p < 0.05$), while the effect size according to Cohen (Cohen's d) showed medium and high practical significance.

Keywords: *handball, educational process, speed-strength training.*

Introduction. An analysis of research and observations of professional handball teams shows that the effectiveness of the performance of playing actions is largely determined by the level of development of speed-strength qualities, and above all of explosive strength [1, 4, 7]. However, in the practice of preparing female handball players in the educational and training groups ETG-1 and ETG-2, there is insufficient implementation of programmes ensuring the comprehensive development of both the morphological (hypertrophy of the fast muscle fibres) and the functional (activation of the central nervous system, neuromuscular coordination) components of the motor system.

Objective of the study is to substantiate the influence of the experimental programme of the educational and training process that has been developed, with an emphasis on speed-strength preparation, on

the explosive strength of the lower and upper limbs in female adolescents, as well as its influence on the effectiveness of competitive activity.

Methods and structure of the study. The experimental programme for the application of speed-strength exercises was modelled on the basis of training sessions three times a week lasting 120 minutes each, comprising: a) general and special physical preparation, including preparation aimed at improving joint mobility; b) specialised exercises for developing agility, coordination and speed of reaction; c) strength exercises using weights (barbells, dumbbells, machines) in the intensity zone of 70–90 % of the maximum indicator, with near-maximal loads performed with a minimum number of repetitions per exercise (2-4) and 4-6 sets in each exercise; d) plyometric exercises with the athlete's own body weight (depth jumps);



e) basic handball and playing sessions. The scientific experiment was carried out at the Kadyrbek Ospanov Children's and Youth Sports School No. 1 of the city of Kostanay over 17 weeks from 19 September 2024 to 19 January 2025. The study contingent consisted of the female handball players of the junior team of the first league of the Republic of Kazakhstan of the Kostanay Region. The majority of the athletes are candidates for master of sport, prize-winners of international tournaments, and three-time prize-winners of the championships of the Republic of Kazakhstan.

A total of 26 athletes of the main and reserve squads of the team of the Kostanay Region took part in the experiment, including 7 back-court players, 7 wings, 5 pivots, 4 playmakers and 3 goalkeepers.

Twenty-six female adolescents aged 13-14 years were divided, on the basis of playing position, anthropometric data and test results, into two equivalent groups: an experimental group (EG; $n=13$) and a control group (CG; $n=13$). The battery of motor tests consisted of five trials: the standing long jump (SLJ), the triple jump from a standing position (TJSP), the high jump (HJ), the throwing of a 3 kg medicine ball (TMB), and the shuttle run with a touch of a marker at 3 metres, 6 times (SR).

The sessions under the experimental programme were held 3 times a week (Tuesday, Thursday, Sunday), with a training duration of 2 hours from 17:00 to 19:00, one of the sessions – on Sunday – being an unloading session, with constant monitoring of the physical and physiological state of the athletes and analysis of their influence on the effectiveness of playing activity. Each month, monitoring using the basic motor tests was carried out in the control and experimental groups, together with an expert assessment of the playing activity of the participants in the experiment. The system of speed-strength exercises was built on the understanding that the intensity, duration and speed of performance of the exercises influence the process of activation of the fast motor units.

The results of the expert assessment were compared with the results of the motor tests (SLJ, TJSP, HJ and so on) using mathematical and statistical data processing, which made it possible to establish significant correlations between the gain in speed-strength qualities and the increase in the effectiveness of playing actions in handball.

Results of the study and discussion. The final results were subjected to mathematical processing (Table 1).

Statistically significant differences between the groups were established in the following tests:

Standing long jump: $t = 2.13$; $p = 0.044$; effect size Cohen's $d = 0.86$.

High jump: $t = 2.46$; $p = 0.021$; effect size Cohen's $d = 1.79$.

Shuttle run: $t = 2.15$; $p = 0.042$; effect size Cohen's $d = 0.84$.

In all the tests indicated, the significance level proved to be below the threshold value ($p < 0.05$), which indicates the high effectiveness of the experimental programme in developing the speed-strength qualities of the lower limbs. The effect sizes of the differences (Cohen's d) varied from 0.86 to 1.79, which indicates the high practical effectiveness of the model developed.

In the triple jump and medicine ball throw tests, the differences between the experimental and control groups did not reach the level of statistical significance ($p > 0.05$), possibly because of the large scatter of the results (σ_x/σ_y).

In addition to the quantitative results, it is also important to note the qualitative observations. In the opinion of the qualified expert coaches who took part in the observation of the experiment, the athletes of the experimental group demonstrated not only a gain in results but also an increase in general working capacity and confidence in performing the tasks, and an improvement in coordination and stability when performing jumping exercises. The positive influence of

Table 1. Statistical values and significance of the differences after the experiment

Indicator	CG ($\bar{X} \pm \sigma$), $n=13$	EG ($\bar{Y} \pm \sigma$), $n=13$	t	p	Significance of the differences
SLJ, cm	180.3 $\pm$ 14.4	193.0 $\pm$ 15.9	2.13	0.044<0.05	The differences are statistically significant
TJSP, cm	551.8 $\pm$ 44.1	566.1 $\pm$ 39.3	0.87	0.39>0.05	There are no statistically significant differences
HJ, cm	33.2 $\pm$ 4.5	41.2 $\pm$ 4.4	2.46	0.021<0.05	The differences are statistically significant
TMB, cm	264.4 $\pm$ 33.3	272.9 $\pm$ 34.2	0.64	0.53>0.05	There are no statistically significant differences
SR, s	16.0 $\pm$ 1.4	14.9 $\pm$ 1.2	2.15	0.042<0.05	The differences are statistically significant



the comprehensive programme on the playing indicators was particularly emphasised.

Besides the growth of speed-strength characteristics, an improvement in playing indicators was noted in the athletes of the experimental group:

The conversion rate of shots at goal increased on average by 11-16 %, which indicates an increase in the power and accuracy of attacking actions.

The number of scoring attacks increased; a rise in the average productivity of attacks by 1.5–2 effective shots per match was recorded.

The number of technical errors decreased (inaccurate passes, losses of the ball) owing to the improvement in the speed of reactions and in coordination.

The speed of changes of direction of movement and of moving into free positions improved, which was particularly evident in matches against stronger opponents.

The level of interaction between players in attacking actions increased, which was expressed in a rise in the number of fast breaks and second-wave attacks.

In the control group no analogous improvements were observed: the gain in speed-strength indicators was insignificant, and the playing indicators remained practically at the previous level or changed within the limits of statistical error. An analysis of the competitive activity of the athletes in 2024–2026 confirms the high effectiveness of the experimental programme of preparation. The athletes of the experimental group achieved the following results:

Table 2. Statistics of the Kostanay – Minsk matches, 2024, experimental group

Kostanay – Minsk RCOR match (score 16-30), September 2024 – before the introduction of the experiment													
Player's name	Position	Goals				Penalties (7 m)		Ball retention		Mistakes			
Experimental group	Playing role	Goals	Shots	Breaks	Eff. %	Attack	Defense	Steals	Block	Losses	Yellow	2-min	Red
Kseniya M.	Right wing	0	3	–	0 %	2	–	1	–	4	–	–	–
Mariya D.	Pivot	0	1	–	0 %	–	–	–	–	3	–	–	–
Olga K.	Centre back	0	3	–	0 %	–	–	–	–	–	–	–	–
Karolina K.	Left back	2	4	–	50 %	1	–	–	–	2	–	–	–
Ekaterina D.	Pivot	1	1	–	100 %	–	–	–	1	2	–	–	–
Anzhelika O.	Left back	9	13	1	69 %	4	2	1	–	2	1	–	1
Sofiya A.	Pivot	–	–	–	0 %	–	–	–	–	–	–	–	–
Aziza T.	Left wing	–	–	–	0 %	–	–	–	–	–	–	–	–
Ariana T.	Pivot	–	–	–	0 %	–	–	–	–	1	–	–	–
Aleksandra L.	Centre back	0	1	–	0 %	–	–	–	–	–	–	–	–
Madina K.	Right wing	–	–	1	0 %	–	–	–	–	–	–	–	–
		Time on court	Saves	Shots	Eff. %	Penalties (shots, saves)				Mistakes			
Veronika O.	Goalkeeper	0'	0	0	0 %	–	–			–	–	–	–
Ani N.	Goalkeeper	10'	1	5	20 %	1	0			1	–	–	–

Kostanay – Minsk RCOR match (score 23-30), December 2024 – after the introduction of the experiment													
Player's name	Position	Goals				Penalties (7 m)		Ball retention		Mistakes			
Experimental group	Playing role	Goals	Shots	Breaks	Eff. %	Attack	Defense	Steals	Block	Losses	Yellow	2-min	Red
Kseniya M.	Right wing	3	4	3	75 %	4	1	–	–	2	–	–	–
Mariya D.	Pivot	1	2	–	50 %	–	–	–	1	–	–	–	–
Olga K.	Centre back	–	–	–	0 %	–	–	–	–	–	–	–	–
Karolina K.	Left back	7	9	1	78 %	–	–	1	1	1	–	–	–
Ekaterina D.	Pivot	2	3	–	67 %	1	–	–	–	1	–	–	–
Anzhelika O.	Left back	8	10	1	80 %	4	–	1	1	1	–	1	–
Sofiya A.	Pivot	–	–	–	0 %	–	–	–	–	–	–	–	–
Aziza T.	Left wing	–	–	–	0 %	–	–	–	–	–	–	–	–
Ariana T.	Pivot	–	–	–	0 %	–	–	–	–	–	–	–	–
Aleksandra L.	Centre back	–	–	–	0 %	–	–	–	–	–	–	–	–
Madina K.	Right wing	–	–	2	0 %	–	–	–	–	–	–	–	–
		Time on court	Saves	Shots	Eff. %	Penalties (shots, saves)				Mistakes			
Veronika O.	Goalkeeper	2'	1	2	50 %	1	1			–	–	–	–
Ani N.	Goalkeeper	10'	4	5	80 %	–	–			–	–	–	–



2024, results of the competitions before and after the experiment (Table 2).

2025, 19-31 October, the 3rd Asian Youth Games, Manama, Bahrain (with the participation of some of the athletes of the experimental group) – 3rd place.

10-16 January, Moscow, the international tournament of the Moscow Handball Academy – 3rd place (including 2 athletes named best player of a match and 1 athlete named best player of the tournament); following the results of the First Asian Handball Championship for girls under 16, four athletes (Anzhelika O., Olga K., Kseniya M., Karolina M.) fulfilled the standard for the award of the title of International Master of Sport of the Republic of Kazakhstan.

Proceeding from the analysis of playing activity before and after the experiment, in the experimental group a positive dynamic of growth of the playing indicators is observed: the average indicator of effectiveness rose from 24 % to 37 %.

With the aim of identifying the interrelations between the five physical indicators and the percentage of playing effectiveness in the experimental group before and after the experiment, the coefficient of determination was determined by means of multiple linear regression analysis: $R^2 = 0.89$, which indicates a strong statistically significant interrelation between speed-strength preparation and playing performance. The set of five indicators is statistically significant and is associated with the gain in playing effectiveness. Testing the overall significance of the regression model by means of Fisher's F-test also showed that the model is statistically significant ($F = 11.33 > F_{crit} = 3.97$; $df_1 = 5$; $df_2 = 7$; $p < 0.01$). The results obtained indicate that the set of indicators studied reliably explains the variation in the playing effectiveness of the athletes. At the same time, the small sample size requires caution in interpreting the results and generalising them ($n=13$). Although the model as a whole (according to the F-test) is significant, only one of the five factors included in it showed individual statistical significance – the gain in shuttle run time (SR). In our case this is connected with the multicollinearity of the indicators included. Their gains correlate strongly with one another. Because of this interrelation the model as a whole works well, but it is difficult to separate out the pure contribution of each individual indicator. The contributions of the jumping tests are 'blurred' by their close relationship with speed.

Conclusions. Thus, the results of the research confirm the high effectiveness of the experimental programme developed for the use of speed-strength

and strength exercises with weights in the intensity zone of 70-90 % of the maximum indicator.

The positive dynamics of shot conversion, of the growth in the number of fast breaks and of the quality of transitions from defence to attack indicate that the programme exerts an influence not only on morphological indicators but also on the speed of decision-making, the confidence of the athletes and their playing thinking. These qualities are critically important in contemporary handball, where a single fast attack may influence the outcome of a match.

References

1. Del Vecchio A., Casolo A., Negro F., Scorcelletti M., Bazzucchi I., Enoka R., Felici F., Farina D. The increase in muscle force after 4 weeks of strength training is mediated by adaptations in motor unit recruitment and rate coding. 2019. URL: <https://pubmed.ncbi.nlm.nih.gov/30727028/>
2. Li Y., Guo Q., Shao J., Gan Y., Zhao Y., Zhou Y. Neuromuscular factors predicting lower limb explosive strength in male college sprinters. *Front Physiol.* 2024. URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11746912/>
3. Makaruk H., Starzak M., Tarkowski P., Sadowski J., Winchester J. The Effects of Resistance Training on Sport-Specific Performance of Elite Athletes: A Systematic Review with Meta-Analysis. *J Hum Kinet.* 2024. URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11057612/>
4. Murugavel Dr., Ethiraj B. Influence of Maximal Power Training With and Without Plyometrics on Maximum Speed and Leg Explosive Power of Men Team Handball Players. 2020. URL: <https://www.researchgate.net/publication/346020708>
5. Santos P.D.G., Vaz J.R., Correia J., Neto T., Pezarat-Correia P. Long-Term Neurophysiological Adaptations to Strength Training: A Systematic Review With Cross-Sectional Studies. 2023. URL: <https://pubmed.ncbi.nlm.nih.gov/37369087/>
6. Sivokhin I.P., Belegov A.N., Skotnikov V.F., Fedorov A.I., Tapsir M., Kalashnikov A.P., Komarov O.Yu. Eksperimentalnaya otsenka effektivnosti razlichnykh metodov silovoy trenirovki. *Teoriya i praktika fizicheskoy kultury.* 2017. No. 11. Pp. 77-82.
7. Hermassi S., Chelly M.S., Fathloun M., Shephard R.J. The effect of heavy- vs. moderate-load training on the development of strength, power, and throwing ball velocity in male handball players. *J Strength Cond Res.* 2010. URL: <https://pubmed.ncbi.nlm.nih.gov/20706155/>



Interrelation of the psychophysiological parameters of sambo wrestlers with the results of competitive activity

UDC 796.814



PhD, Associate Professor **N.A. Fedyaev**¹

I.S-Kh. Musaev¹

A.L. Insarov²

¹Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Moscow

²Moscow State Institute of International Relations (University) of the Ministry of Foreign Affairs of the Russian Federation, Moscow

Corresponding author: kolyajud@mail.ru

Received by the editorial office on 14.06.2026

Abstract

Objective of the study is to determine the level of interrelation of the psychophysiological parameters of sambo wrestlers of various qualifications with the results of competitive activity.

Methods and structure of the study. The study of the psychophysiological parameters of the wrestlers was carried out on the PAKF-01 hardware and software complex using 11 tests.

Results and conclusions. An interrelation was revealed between the results in competition and the balance of the nervous processes, in particular the mobility and strength of the nervous processes. A negative interrelation was also established between the results in competition and the strength of the nervous processes as determined by the indicators of the tapping test. The results of the study made it possible to determine the most important components of the psychophysiological indicators of sambo wrestlers of various qualifications that influence the result in competition, and to use these results in the educational and training process during psychological preparation.

Keywords: *sambo wrestlers, psychophysiological parameters, individualisation, sporting selection, competitions.*

Introduction. As is well known, psychological preparation is an important link in the training and competitive processes of athletes at all stages of the development of mastery and is inseparably connected with the reaction of the body to one or another stimulus. This becomes particularly relevant at the stages of in-depth training and sporting improvement, where the differences between athletes in respect of physical preparation are gradually levelled out or are to a certain degree compensated for by an improvement in coordination abilities or in the individual features of technique.

Objective of the study is to determine the level of interrelation of the psychophysiological parameters of sambo wrestlers of various qualifications with the results of competitive activity.

Methods and structure of the study. Twelve sambo wrestlers of various qualifications (wrestlers of First Category and Candidates for Master of Sport) took part in the examination. The study of the psycho-

physiological parameters of the wrestlers was carried out on the PAKF-01 hardware and software complex using the following 11 tests: a test for the investigation of functional asymmetry; a test to determine the functional state of the cortical section of the visual analyser by the critical flicker fusion frequency; a test to determine the throughput capacity of the visual analyser; a questionnaire test for the subjective assessment of the psycho-emotional sphere; a test to determine the parameters of the complex visual-motor reaction to the presentation of combined light signals in an arbitrary rhythm; a test to determine the ability to reproduce time intervals and the length of lines without visual control; a test to determine the parameters of the visual-motor reaction to a unilaterally moving object; the tapping test (60 s); and a test to determine the parameters of the complex visual-motor reaction to the presentation of combined light signals in an imposed regular rhythm.



Results of the study and discussion. In analysing the competition protocols, we determined the place of each athlete taking part in the study; it ranged from 1st to 10th place. The spread of places was determined by the weight category and by the athlete's preparedness for the particular start.

We then carried out a correlation analysis between the indicators of the psychophysiological tests and the results in competition, proceeding from 1st place. The results are presented in Tables 1 and 2.

It should be taken into account that these tables bring together the results showing the closest interrelation. For all the other indicators a weak dependence is observed, or no interrelation exists.

In determining the interrelation between the results in competition and lability, we found that the most dependent factors were the critical flicker fusion frequency (CFFF) of the right eye for the colour red ($r = 0.5$) and the critical flicker discrimination frequency (CFDF) of the right eye for red light ($r = -0.6$) (Table 1).

The predominance of the lability of the right eye with a response to the colour red may be explained by the leading role of the left hemisphere of the brain and is connected with functional asymmetry. One of the reasons for the response to the colour red is possibly the distribution of the colours of the mat (at the edge of the mat there is a one-metre zone of red colour) and the competition rules (a free step outside the mat is penalised).

Speaking of the average value of the CFFF, it may be said that it is at a low level of lability, whereas the CFDF is at a high level of lability. These results may be explained by the fact that during a bout the athlete places great emphasis on determining her or his po-

sition on the mat relative to the edge of the wrestling zone, while the level of the CFFF is sufficient for responding in wrestling, which is confirmed by the different signs of the correlation coefficient. The next component that influences the formation of the competitive result is the complex sensorimotor reaction (Table 1), which is reflected in our study by three indicators: the latent reaction time, the total reaction time and the motor component of the reaction. All three indicators have a positive interrelation with the results in competition and lie in the middle range. A change in reaction time in the direction of decrease entails an improvement in the sporting result. In our study an interrelation was observed between the results in competition and the balance of the nervous processes, in particular the processes of mobility and the strength of the nervous processes. These indicators were expressed in the ability to reproduce the length of lines without visual control. In assessing the testing results, we found that the processes of excitation and inhibition were at approximately the same level, but were more pronounced in the direction of inhibition. One of the reasons for such a result may be the confidence of the athletes of this group in a successful performance (Table 1).

In assessing the mobility of the nervous processes (Table 2), the greatest interrelation of the results in competition is traced with the response to the colour red ($r = -0.5$) and blue ($r = 0.5$) at a frame presentation rate of 90 frames/min, which may likewise be explained by the relationship between the colour of the mat and the clothing of the sambo wrestlers.

At this same rate an interrelation of the results with the number of errors in performing the test procedure is observed ($r = 0.9$).

Table 1. Interrelation of the psychophysiological indicators with the results in competition

Test methods	Balance of the nervous processes		Lability		Complex sensorimotor reaction		
Indicator	Number of lengthened lines	Number of shortened lines	CFFF, right eye / red (Hz)	CFDF, right eye / red (Hz)	LRT (ms)	Total reaction time (ms)	Motor component of the reaction (ms)
m	9.3±8.0	9.1±7.4	32±4.7	42.4±6.3	394±2.2	500±82.4	117±52.5
r	0.7	-0.6	0.5	-0.6	0.5	0.5	0.5

Table 2. Interrelation of the psychophysiological indicators with the results in competition

Test method	Mobility of the nervous processes			Tapping test	
Indicator	Presses per s at a frame rate of 90 frames/min (red)	Presses per s at a frame rate of 90 frames/min (blue)	Number of errors at a frame rate of 90 frames/min	Number of taps in 10 s	Volitional effort (conv. units)
m	4.8±2.4	5.1±2.1	25.9±20.1	59.4±9.1	666.7±104.2
r	-0.5	0.6	0.9	-0.6	-0.5



By the percentage ratio of the number of errors (no more than 5 % of the number of stimuli presented is permissible), it may be said that the level of functional mobility of the nervous processes of the wrestlers of this sample is at an average level.

A negative interrelation was also revealed between the results in competition and the strength of the nervous processes as determined by the indicators of the tapping test (Table 2). This result indicates that with an increase in the number of taps – and consequently with an increase in the strength of the nervous processes – effectiveness improves. The average indicator of the number of taps in 10 seconds corresponded to an average strength of the nervous processes. It should be taken into account that the manifestation of volitional effort in performing the test also has a negative interrelation with the results in competition and influences the indicator in the testing.

The level of anxiety played a considerable role in the place taken in competition, which is confirmed by their interrelation ($r = 0.6$). This indicator shows that with an increase in the level of anxiety the competitive result deteriorates.

Conclusion. Thus, the analysis of the results obtained made it possible to determine the most important components of the psychophysiological indicators of sambo wrestlers of various qualifications that influence the result in competition, and to use these results in the educational and training process during psychological preparation.

References

1. Bakiev D.A., Khalfina R.R., Shibkova D.Z. Zavisimost rezultata kontrolnogo uprazhneniya po strelbe ot psikhomotornykh funktsiy sotrudnikov organov vnutrennikh del. *Teoriya i praktika fizicheskoy kultury*. 2016. No. 7. Pp. 44-46.
2. Muftakhina R.M., Shayakhmetova E.Sh. Otsenka nekotorykh psikhofiziologicheskikh funktsiy edinoborcev v khode trenirovochnykh nagruzok. *Teoriya i praktika fizicheskoy kultury*. 2009. No. 4. Pp. 76-77.
3. Ozerov V.P. *Psikhomotornoye razvitiye sportsmenov*. Otv. red. B.B. Kossov. Kishinev: Shtiintsa, 1983. 139 p.
4. Fakeev M.A. Eksperimentalnoye obosnovaniye metodiki uskorennoy formirovaniya psikhomotornykh funktsiy yunikh sportsmenov-rukopashnikov. *Uchenye zapiski universiteta imeni P.F. Lesgafta*. 2010. No. 4(62). Pp. 108-111.
5. Fedyaev N.A., Nikitchenko S.Yu., Melentev A.N., Musaev I.S-Kh. Metody issledovaniya sportivno-vazhnykh psikhomotornykh funktsiy bortsov. *Psikhologiya. Istoriko-kriticheskiye obzory i sovremennyye issledovaniya*. 2024. V. 13. No. 3-1. Pp. 140-146.
6. Shulpina V.P., Pavlova N.V. Metodika otsenki psikhofiziologicheskogo i psikhomotornogo sostoyaniya sportsmenov BMX na etape sportivnogo sovershenstvovaniya. VIII Mezhdunar. nauch.-prakt. konf. psikhologov fiz. kultury i sporta «Rudikovskiy chteniya», 5-7 iyunya 2012 g.: materialy. Moskva, 2012. Pp. 277-279.



Powerlifting as an example of a socio-pedagogical system in strength sports

UDC 796.89:37.013



PhD, Associate Professor **E.V. Markin**

Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Moscow

Corresponding author: kupec2007@mail.ru

Received by the editorial office on 12.06.2026

Abstract

Objective of the study is to analyse the principal moments of the history of the emergence and development, and the foundations of the theory, methodology and methods of the training and competitive processes, of powerlifting, on the basis of which powerlifting can and should be regarded as a socio-pedagogical system of strength sport.

Methods and structure of the study. The research was organised in accordance with the norms and rules for the preparation and conduct of a descriptive study by the method of document analysis. The material is presented in the format of a scientific article.

Results and conclusions. The historical heterogeneity of the formation of powerlifting under different socio-ideological conditions predetermined the dominance of the American model, whereas the Russian system, having passed through late institutionalisation, ideological pressure and a change of context, today retains an internal contradictoriness as a natural reflection of the complexity of the social background itself.

Keywords: *socio-pedagogical system, strength sports, powerlifting, American and European versions, weightlifting, athleticism, strength triathlon, transformation of the social context, contradictoriness of the socio-pedagogical system.*

Introduction. By virtue of the labour-intensiveness of its training process, one of the most recognised and professional forms of strength preparation is deservedly powerlifting, which might be called the right marker of the strength direction of sport. The danger to health and the resulting obligatory systemic organisation of powerlifting sessions require it to be viewed as a pronounced – although by no means universally recognised – socio-pedagogical system.

The appearance in the specialist literature of the concept of the socio-pedagogical system of a sport or of a whole sporting direction is determined, first, by the fact of the unconditional and pronounced socio-historical origin of absolutely any sport. Second, the concept of the socio-pedagogical system makes it possible to identify and take into account by which pedagogical means, and precisely which parameters of the personality, one or another sport is intended ex-

plicitly or implicitly to form and/or correct. Third, the application of the concept of the socio-pedagogical system of a form and/or direction of sport, as of sport as a whole, makes it possible to build social policy and social forecasting in the field of physical culture and sport on a scientifically well-founded basis, which is particularly relevant in a situation of competition and struggle between states in the external political arena.

An analysis of powerlifting as an example of a socio-pedagogical system in strength sports must, without any doubt, touch upon the principal moments of its history, the characteristics of the social context of its emergence and development, and the foundations of the theory, methodology and methods of its training and competitive process.

Objective of the study is to analyse the principal moments of the history of the emergence and development, and the foundations of the theory, method-



ology and methods of the training and competitive processes, of powerlifting, on the basis of which powerlifting can and should be regarded as a socio-pedagogical system of strength sport.

Methods and structure of the study. The work was organised in accordance with the norms and rules for the preparation and conduct of a descriptive study by the method of document analysis; the material is presented in the form and format of a scientific article.

Results of the study and discussion. Today powerlifting, as a specific bodily and motor culture uniting millions of people, belongs not only to sport. In addition to the already traditional sporting model, powerlifting simultaneously has several other social models and prospects for development, known as:

- a discipline of physical culture and education;
- a form of festive and playful mass leisure and recreation;
- a programme for maintaining the physical health and active longevity of veterans, that is, of people of advanced age, in their seventies and even eighties;
- a form and programme of social rehabilitation for people with physical disabilities;
- a subculture of the professional strength show or strength-extreme show.

What, then, unites all these models? In the apt expression of N.N. Vitkevich – one of the respected veterans and organisers of powerlifting and armlifting competitions – all these models are represented by stern people who, in gloomy basements, achieve power over metal through hard and persistent labour. It seems to us that this phrase expresses very precisely and concisely the socio-psychological portrait of the typical ‘lifter’, and consequently also the pedagogical influence exerted on the personality by systematic powerlifting training.

As regards scientific publications in the field of powerlifting, the majority of them concern only methodological matters. Publications on the socio-pedagogical system of powerlifting, on its philosophy and psychology, are with extremely rare exceptions entirely absent, which calls into question the very existence of a scientific methodology of powerlifting [3]. An analysis of the historical formation of powerlifting in the context of the research topic shows the following:

- according to one version, the homeland of powerlifting is the USA, and specifically Leo Stern’s weightlifting beauty club in San Diego (date of opening – 1939; competitions in non-traditional weightlifting and body-building – 1947; competitions in the odd

lift, which included the bench press, the squat and the deadlift – 1948);

- according to another version, the homeland of powerlifting is Great Britain, where as early as before 1950 competitions in the Strength Set were held, including the biceps curl, the bench press and the squat. In 1965 the biceps curl was replaced by the deadlift, after which the term ‘powerlifting’ (power – strength, lift – to raise) or ‘strength triathlon’ appeared, that is, the lifting of a barbell of maximum weight in the sum of three movements: the squat with the barbell on the shoulders, the press of the barbell while lying on a horizontal bench, and the deadlift. The first international powerlifting meeting between the teams of Great Britain and France took place in Bristol in 1968. The following year the international meeting was already held in France;

- until 1970 national powerlifting championships were held in parallel in the USA and Great Britain, and the first international meeting of American and English powerlifters took place in Los Angeles. The first World Powerlifting Championship of 1971 between the American and English teams was also held in the USA, in the city of York, Pennsylvania. And in 1972 the second world championship was held in the city of Harrisburg (Pennsylvania) and the International Powerlifting Federation – IPF – was created, with representatives of the USA, Great Britain, Canada, Puerto Rico, Jamaica and Zambia;

- by the end of the 1970s the teams of two dozen countries of Europe, Africa, Asia, North America, South America and Oceania were already taking part in the world powerlifting championships. In the 1970s and 1980s the athletes of the USA held indisputable leadership;

- the first women’s world powerlifting championship also took place in the USA, in Lowell, Massachusetts, in 1980. Subsequently, up to 1988, the women’s team of the USA won eight of the nine world championships (only in Adelaide in 1983 did the States yield to Australia);

- the initiators of the addition of a separate ‘veterans’ class with separate world championships were also the USA, although competitions in ‘combined’ (men’s and women’s) powerlifting were first held in Canada, in Sydney, in 1989;

- only in the 1990s did the national affiliation of the men’s world powerlifting champions change. The Americans and Scandinavians gradually yielded leadership to athletes from Eastern Europe: Russians,



Ukrainians and Poles. And Russian female athletes, with literally two exceptions, won practically all the weight categories at the world championships from as early as 1991. On the whole, the 1990s were a time of the indisputable leadership of the powerlifting of Russia, Ukraine and Poland;

- in 2006 the national teams of Russia and Ukraine were disqualified for the use of doping. And only in 2009 did the Russian team, weakened by the disqualifications, once again achieve a triumphant victory.

It should be particularly noted that private investment and sponsorship played an enormous role in the organisation and conduct of national competitions and world powerlifting championships. For example, one of the best known and most respected sponsors was the American Bob Hoffman.

An analysis of the Russian history of the formation of powerlifting made it possible to establish the following:

- during the years of its formation in the West, in the USSR it fell under a ban (alongside the Eastern martial arts and body-building as a model of bourgeois culture) and was forced to go underground – more precisely, into the basements. In order at least partially to legalise it, powerlifting was renamed athletic gymnastics and was ideologically opposed to the body-building of the West, which was said at the time to be based on profitable business, advertising, competition, and the cult of individualism, strength and the superman.

In the USSR athletic gymnastics was initially regarded as one of the directions of the unified complex of the physical education of the harmoniously and comprehensively developed Soviet person, namely as exercises with weights. From this a completely false conclusion was drawn: that athleticism should on no account adopt the 'bourgeois' methods and means of the training and competitive practice of body-building, in particular those allegedly aimed exclusively at the effective building of muscle mass;

- however, despite all the bans and obstacles, the popularity of athleticism in the USSR continued to grow, which compelled the All-Union Conference on Gymnastics (Moscow, 1968) to assign the new sport to the section of general developmental forms of gymnastics and to place it under the ideological control of the organs of the Komsomol. And in order not to contradict too strongly the concept of the harmonious and comprehensive development of the personality, the ideologists of sport began to devise various ways of 'correcting' the one-sidedness of athletic gymnastics,

for example by including pull-ups and standing jumps in the competition programme, and by excluding the deadlift from the programme;

- the project for the domestic development of methodological recommendations and competition rules for athletic gymnastics, entrusted to the All-Union Research Institute of Physical Culture (VNIIFK), was drawn out over 10 years (from 1966 to 1974) and was approved only in 1978;

- the All-Union Commission of Athletic Gymnastics under the Weightlifting Federation of the USSR was created only in 1979, opening up the prospect of the development of this discipline in – of all places – the Baltic republics. And in the same year one of the first All-Union tournaments in strength exercises was held in Iauliai (Lithuanian SSR). At these competitions juniors in three weight categories competed in the bench press and the triple jump, and men in four categories in the bench press and the squat. It was precisely the open championships of the Lithuanian SSR, which subsequently became annual, as well as the championships of the Estonian SSR, that were considered the most prestigious and progressive (five weight categories and the inclusion of the deadlift for men) at least up to 1985;

- in 1987 the USSR State Committee for Sport approved the competition rules for athletic gymnastics submitted by a special commission of the Weightlifting Federation of the USSR. Despite the terminological amendments, it was already recognised that the order of the exercises should correspond to the norms of the world and European powerlifting championships, that the USSR championships in strength triathlon should be placed on a separate footing, and that the organisational work should be conducted by an independent federation for the sport;

- the first RSFSR championship in athleticism (strength triathlon) in 8 weight categories was held in Krasnoyarsk in 1988. In the same year the Athleticism Federation of the USSR held the USSR Cup in athleticism in Tyumen and the international USSR – USA meetings in Leningrad and Moscow. At these, only one Soviet athlete (Vladimir Mironov), in Leningrad, managed to outperform his American colleagues. At the same time the American athletes, while rating the potential of their rivals highly, noted their lack of normal training equipment, of special gear and, most importantly, of experience of participation in international competitions. Serious errors in training methods and competitive practice – errors that limited achievement



and were fraught with injury, and that were a legacy of the outdated weightlifting style – were also quite justifiably mentioned;

– in 1990 the independent Strength Triathlon Federation of Russia was created, having separated from the Athleticism Federation of the RSFSR. And from that same year the triumphant ascent of Russian powerlifters at the world championships began.

Conclusions. Summarising the above, it may be stated that the socio-pedagogical system of strength triathlon was historically formed in parallel in the USA, Western Europe and Eastern Europe under the conditions of different socio-economic structures and ideological attitudes, which predetermined its internal contradictoriness and ambiguity.

At the same time, the most organic and authentic version with respect to the specific social context at all stages of development was the American version of powerlifting, oriented towards private capital, market competition, self-promotion and the cult of individualism, whereas the Western European and Eastern European variants were gradually transformed in its direction, including the technical devices and methods which, although implicitly, proved to be dependent on a worldview of pragmatism.

The deepest and most painful transformation was undergone by the Russian model, which was conditioned by its late (by 25–30 years) emergence from the influence of weightlifting, by the prolonged attempts of the Soviet leadership to adapt an alien discipline to socialist ideology and the traditions of physical education, and also by the emphasis of Soviet science on theoretical and methodological developments as opposed to Western technological and equipment-related pragmatism.

As a result, contemporary Russian powerlifting practice has been brought into correspondence with the changed social context, which is connected with the restoration of capitalist relations in the country; however, the persisting complexity and contradictoriness of the Russian system is determined precisely by this last circumstance in combination with the inertia of the Soviet worldview and ideological survivals, so

that the general ambiguity of the social environment is inevitably reflected in the particular aspects of the functioning of this system.

References

1. Alkemayer T. Sotsiologiya sporta. Logos. 2006. No. 3(54). Pp. 141-146.
2. Aptekar M.L. Tyazelaya atletika: spravochnik. Moskva: Fizkultura i sport, 1983. 415 p.
3. Arnold P. Sorevnovatelnyy sport, pobeda i vospitaniye. Gumanisticheskaya teoriya i praktika sporta. Vyp. tretiy: sb. Moskva – Surgut: MGIU. 2000. Pp. 131-148.
4. Balakhnichyev V.V. Gosudarstvennaya politika po razvitiyu fizicheskoy kultury i sporta v Rossiyskoy Federatsii. Puti povysheniya sotsialnoy znachimosti fizicheskoy kultury i sporta: materialy Vseros. nauch.-prakt. konf., g. Kazan, 15-16 okt. 2002 g. Kazan: RTsIM. Pp. 11-14.
5. Vakan L. Sotsialnaya logika boksa v chernom Chikago: k sotsiologii kulachnogo boya. Logos. 2006. No. 3(54). Pp. 104-140.
6. Varyushina V.V., Sagalakov D.A. VII Mezhd. nauchnyy kongress «Sovremennyy olimpiyskiy sport i sport dlya vsekh». 2003. V. 1. SportAkademPress. Pp. 120-122.
7. Vizitey N.N., Manolaki V.G. Ideya olimpizma i realii sovremennogo mira. Teoriya i praktika fizicheskoy kultury. 2011. No. 1. Pp. 43-47.
8. Kraevskiy V.V. Nauki ob obrazovanii i nauka ob obrazovanii (metodologicheskiye problemy sovremennoy pedagogiki). Voprosy filosofii. 2009. No. 3. Pp. 77-82.
9. Muravev V.L. Pauerlifting. Put k sile. Moskva: Izdatelstvo «Svetlana P», 1998. 213 p.
10. Neverkovich S.D. Pedagogika fizicheskoy kultury i sporta: uchebnik. Moskva: Fizicheskaya kultura, 2006. 528 p.
11. Saraf M.Ya. Sport i kultura (istoricheskiy analiz). Sport, Dukhovnye tsennosti, Kultura. Vyp. pervyy: sb. Sost. i red. V.V. Kuzin, V.I. Stolyarov, N.N. Chesnokov. Moskva: Gumanitarnyy Tsentr «SpArt» RGAFK, 1997. Pp. 51-83.



Analysis of the dynamics of injuries to the musculoskeletal system of track-and-field athletes at the stage of sports specialisation in the annual cycle: a theoretical aspect

UDC 796.015



Postgraduate student **E.S. Sivukhina**¹

Dr. Hab., Professor **V.V. Ponomarev**^{1, 2}

N.A. Kozhura¹

¹Siberian Federal University, Krasnoyarsk

²Krasnoyarsk State Medical University, Krasnoyarsk

Corresponding author: vaspon59@mail.ru

Received by the editorial office on 30.06.2026

Abstract

Objective of the study is to analyse the dynamics of injuries to the musculoskeletal system of track-and-field athletes at the stage of sports specialisation in the annual cycle and to develop scientific and methodological recommendations for their prevention.

Methods and structure of the study. The study was conducted in the period from 2024 to 2025 among athletes engaged in track and field in the city of Krasnoyarsk. The research methods were: analysis of the scientific and methodological literature on the topic of the work; surveys, discussions and questionnaires; analysis of the materials of the athletes' medical examinations; pedagogical observation of the training process; and the systematisation, analysis and recording of the injuries sustained by the athletes at the various stages of sports preparation. The study involved track-and-field athletes of the third, second and first sports categories. The total sample exceeded 120 athletes.

Results and conclusions. In the course of the analytical study, the principal types of injury in athletes engaged in track and field were identified: contusions, dislocations, sprains, nerve entrapments, fractures and others.

The dynamics and the types of injury in the annual cycle of sports preparation were determined. The percentage distribution of the types of injury in athletes across the annual cycle of preparation is presented. On the basis of the quantitative indicators and types of injury identified, the regularities of their occurrence were established and, accordingly, scientific and methodological recommendations for coaches on the prevention of these negative factors in the sports preparation of track-and-field athletes were developed.

Keywords: *analysis, injuries, musculoskeletal system, track-and-field athletes, stage, sports specialisation, annual cycle, dynamics.*

Introduction. Involving the population of the country in mass sports participation is an important state task for the specialists of the physical culture and sport sector. As practice shows, sports participation expands the motor potential and physical capabilities of each individual more effectively, forms sporting skills and builds applied physical readiness. At the same time, one of the factors restraining the development of mass sports participation among the population is the various injuries to the musculoskeletal system. This situation is due above all to the in-

sufficient observance by coaches and specialists of the basic principles of sports preparation: systematic character, gradualness, variability, individualisation, the unity of general and special preparation, and others. As the analysis shows, up to 50 % of young athletes leave sport early because of various injuries, already at the stage of sports specialisation. All this taken together determined the subject matter of the present study, which is aimed at the analysis and systematisation of injuries to the musculoskeletal system of athletes, using the example of track-and-field



participation, and at the development of scientific and methodological recommendations for coaches and specialists on the prevention of these negative factors in sports preparation.

Objective of the study is to analyse the dynamics of injuries to the musculoskeletal system of track-and-field athletes at the stage of sports specialisation in the annual cycle and to develop scientific and methodological recommendations for their prevention.

Methods and structure of the study. The study was conducted in the period from 2024 to 2025 among athletes engaged in track and field in the city of Krasnoyarsk. The research methods were: analysis of the scientific and methodological literature on the topic of the work; surveys, discussions and questionnaires; analysis of the materials of the athletes' medical examinations; pedagogical observation of the training process; and the systematisation, analysis and recording of the injuries sustained by the athletes at the various stages of sports preparation. The study involved track-and-field athletes of the third, second and first sports categories. The total sample exceeded 120 athletes.

Results of the study and discussion. The analytical and practical study carried out contributed to the collection of factual material and, on its basis, to the formulation of the following results:

1. The principal types of injury to the musculoskeletal system of track-and-field athletes in the annual cycle of sports preparation were identified: contusions of the knee, dislocations of the ankle, fractures of the arms and legs, sprains of the ligaments of the hip joints, contusions of the heels, contusions of the thigh, injuries of the elbow joint, strains of the muscles of the posterior and anterior surface of the thigh, sprains of the ligaments of the ankle, and entrapment of the sciatic nerve.

2. The following percentage distribution of the types of injury in the annual cycle of preparation was established: contusions of the knee – 5.3 %; dislocations of the ankle – 14.9 %; fractures of the arm – 6.1 %; fractures of the leg – 3.5 %; sprains of the ligaments of the hip joints – 18.4 %; contusions of the heels – 4.4 %; contusions of the thigh – 1.8 %; injuries of the elbow joint – 3.5 %; strains of the muscles of the posterior surface of the thigh – 14.0 %; strains of the muscles of the anterior surface of the thigh – 6.1 %; sprains of the ligaments of the ankle – 10.5 %; entrapment of the sciatic nerve – 12.3 %.

3. The percentage distribution of injuries to the

musculoskeletal system of track-and-field athletes in the preparatory and base periods of sports preparation was determined: August – 19.3 %; September – 6.1 %; October – 11.4 %; November – 18.4 %; December – 26.4 %; January – 18.4 %.

4. The largest percentage of injuries to the musculoskeletal system in track-and-field athletes falls on: sprains of the ligaments of the hip joints – 18.4 %; dislocations of the ankle joint – 14.9 %; strains of the muscles of the posterior surface of the thigh – 14.0 %; entrapment of the sciatic nerve – 12.3 %; sprains of the ligaments of the ankle joint – 10.5 %.

5. The principal causes contributing to injuries to the musculoskeletal system of track-and-field athletes in the annual cycle of sports preparation were formulated:

A) The accumulation of muscular fatigue of the musculoskeletal system.

B) A high proportion (up to 80 %) of speed-strength, strength and jumping loading on the musculoskeletal system.

C) Sports preparation on hard tracks under the conditions of an indoor athletics arena and other enclosed halls.

D) Concomitant seasonal illnesses (various colds, vitamin deficiency, lack of sunlight and so on).

E) A high proportion of control starts.

F) The intensification of the training process (the race for the sporting result).

The Table presents an analysis of the dynamics of injuries to the musculoskeletal system, which shows that as early as the initial stage of the preparatory period (August) 19.3 % of injuries are observed in young track-and-field athletes, and in the base period (December) up to 27 % of injuries. All this taken together makes it possible to state that coaches violate and fail to observe the methodological principles of the sports preparation of track-and-field athletes in the annual cycle and, more generally, at the stage of sports specialisation, which leads to early injury and to young athletes leaving professional sport.

Conclusions. The study carried out reveals the principal methodological shortcomings and miscalculations of specialists in the process of sports preparation, which must be taken into account and corrected accordingly in the training process of those engaged in sport; this will make it possible to manage and prevent injuries to the musculoskeletal system of track-and-field athletes more correctly.



Table. Distribution of injuries to the musculoskeletal system of track-and-field athletes in the preparatory and base periods of sports preparation in the annual cycle, %

No.	Months of the year	Number of injuries, %
1.	August	19.3
2.	September	6.1
3.	October	11.4
4.	November	18.4
5.	December	26.4
6.	January	18.4

References

1. Kozhura N.A., Ponomarev V.V., Sivukhina E.S. Modelnye pokazateli kompleksnogo kontrolya sportivnoy podgotovlennosti devochek 10-12 let, zanimayushchikhsya troynym pryzhkom s razbega na etape nachalnoy spetsializatsii. Fizicheskaya kultura: vospitaniye, obrazovaniye, trenirovka. 2025. No. 1. Pp. 65-66.
2. Kozhura N.A., Ponomarev V.V., Sivukhina E.S. Profilaktika perenapryazheniya oporno-dvigatel'nogo apparata devochek, zanimayushchikhsya troynym pryzhkom s razbega na etape sportivnoy spetsializatsii. Fizicheskaya kultura: vospitaniye, obrazovaniye, trenirovka. 2026. No. 1. Pp. 71-73.
3. Sivukhina E.S., Ponomarev V.V. Travmatizm kak negativnyy faktor razvitiya massovogo sporta sredi molodezhi: teoreticheskiy aspekt. Sbornik nauchnykh materialov Vserossiyskoy nauchno-prakticheskoy konferentsii s mezhdunarodnym uchastiem «Aktualnye voprosy dopolnitelnogo professionalnogo obrazovaniya v sfere fizicheskoy kultury i sporta». Krasnodar: OOO Izdatel'stvo Ekoinvest. 2025. Pp. 231-234.
4. Sivukhina E.S., Ponomarev V.V. Kompleks massazhnykh tekhnik profilaktiki i vosstanovleniya travm u legkoatletov: teoreticheskiy aspekt. Sbornik XI Mezhdunarodnoy nauchno-prakticheskoy konferentsii «Zdorovye dlya vseh», posvyashchennoy pamyati professora V.Yu. Davydova. Pinsk, Respublika Belarus. 2025. Pp. 35-38.
5. Sivukhina E.S., Ponomarev V.V. Samomassazh kak sredstvo profilaktiki ot peregruzok i travmatizma oporno-dvigatel'nogo apparata sportsmenov v legkoatleticheskikh distsiplinakh. Sbornik IV Mezhdunarodnoy nauchno-prakticheskoy konferentsii po fizicheskoy kulture, sportu i turizmu «Studencheskiy sport: istoriya, sovremennost i tendentsii razvitiya». 2025. Pp. 189- 193.



Development of physical qualities in track-and-field runners at the stage of the improvement of sporting mastery

UDC 796.422.12



PhD, Associate Professor **D.V. Sorokin**

Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Moscow

Corresponding author: sorokin_denis_08@list.ru

Received by the editorial office on 20.06.2026

Abstract

Objective of the study is to provide a theoretical substantiation of a comprehensive methodology for the directed development of the speed-strength abilities, special endurance, strength and flexibility of qualified runners within the framework of the annual cycle.

Methods and structure of the study. An analysis of the scientific and methodological literature was carried out, together with the systematisation of approaches to the periodisation of loads and the identification of the optimal means of developing the leading qualities. An analysis of the sources showed that in highly qualified athletes the limiting factors are special endurance and running economy. The principal approaches rest on the principles of undulating periodisation. The methodology is built on the integration of the means of running preparation, speed-strength exercises, plyometrics and gymnastic complexes.

Theoretical generalisation made it possible to determine a rational distribution of loads: the predominance of aerobic work in the preparatory period with a gradual increase in the share of high-intensity means in the pre-competition cycle. Attention is paid to the individualisation of the training effects with account taken of the morphofunctional features of the athletes and to the monitoring of the recovery of the body. The mechanisms of adaptation to combined loads and the influence of strength preparation on the power of the push-off are examined.

Results and conclusions. The results confirm the effectiveness of an integral approach in which the development of physical qualities is carried out in close interrelation with the improvement of technique. The need to observe the principles of variability and of the correspondence of loads to the level of preparedness is substantiated. It is proposed that the indicated ratios of the volumes and intensity of loads be used with obligatory monitoring of the athlete's state.

Keywords: *development of physical qualities, track-and-field runners, stage of the improvement of sporting mastery, speed-strength preparation, special endurance, periodisation of training.*

Introduction. The relevance of research into the methodology of developing the physical qualities of track-and-field runners at the stage of the improvement of sporting mastery is determined by the contemporary demands placed on the preparation of highly qualified athletes, under which the achievement of stable high results over the middle and long distances is impossible without the purposeful improvement of speed-strength abilities, special endurance, strength and flexibility. At this stage of preparation, qualified runners face the need to optimise the training process under conditions of increasing competi-

tion and limited resources for the recovery of the body.

An analysis of the scientific and methodological literature shows that questions of the rational construction of training loads with account taken of the individual features of athletes and of the principles of periodisation remain at the centre of specialists' attention. The works of Russian authors emphasise the importance of an integral approach to the development of physical qualities within the annual cycle of preparation.

The theoretical substantiation of the topic rests on the generalisation of data on the mechanisms of the



adaptation of the body to combined loads, in which attention is paid to the balance between the volume of aerobic work and purposeful speed-strength effects. The state of development of the problem in the scientific literature confirms the existence of fundamental research on the periodisation of the training process; however, the aspects of the individualisation of means and methods precisely at the stage of the improvement of sporting mastery for runners over distances from 800 to 5000 metres are insufficiently covered. Such an approach makes it possible to identify the gaps in the existing methodologies and to substantiate the need for further theoretical generalisation with the aim of increasing the effectiveness of preparation.

Objective of the study is to provide a theoretical substantiation of a comprehensive methodology for the directed development of the speed-strength abilities, special endurance, strength and flexibility of qualified runners within the framework of the annual cycle.

Methods and structure of the study. The research methodology is based on the theoretical analysis and generalisation of the scientific and methodological literature on the theory and methods of sports training, including works on periodisation, on the means of developing physical qualities, and on the features of the preparation of middle- and long-distance runners. The methods of the systematisation of scientific data, of the comparative analysis of approaches to the construction of the training process, and of the logical modelling of optimal ratios of the volumes and intensity of loads were applied.

The organisation of the study provided for the examination of publications with an emphasis on sources devoted to the stage of the improvement of sporting mastery. In the course of the work, the lead-

ing physical qualities limiting the result in running were identified, with the subsequent determination of the rational means of their development: running exercises of various orientations, plyometric complexes, work with weights of moderate intensity, and gymnastic exercises for maintaining flexibility and strength endurance [1].

Attention was paid to the principles of undulating periodisation, where the preparatory period places the emphasis on creating a base of aerobic endurance, the competition period on the integration of speed-strength and interval loads, and the transition period on active recovery.

The methodology includes recommendations on the distribution of training volumes within the range of 120-180 kilometres per week depending on the period of the cycle, with a pyramidal profile of intensity in which 70-80 per cent of the load falls within the low-intensity zones. Account is taken of the individual morphofunctional features of the athletes through the monitoring of functional state using pedagogical observation and the analysis of the dynamics of the indicators.

The modelling of the methodology was carried out by means of the consecutive generalisation of the data of the literature and the construction of a logical scheme of the annual cycle, in which each period has clearly defined emphases in the development of physical qualities. Attention was paid to the coordination of the means of training with the principles of gradualness, variability and the individualisation of loads (Table 1).

These ratios of means make it possible to ensure the consecutive and interrelated development of all the leading physical qualities, while preserving the necessary balance between load and recovery at each stage of the annual cycle [6].

Table 1. Principal means of developing physical qualities by the periods of the annual cycle

Period of the cycle	Speed-strength abilities	Special endurance	Strength and flexibility
Preparatory	Plyometrics (low intensity), multiple jumps	Long cross-country runs, tempo running	Exercises with weights, gymnastic complexes
Pre-competition	Plyometrics (medium and high intensity), running with weights	Interval training, fartlek	Strength exercises of moderate intensity, stretching
Competition	Speed segments, jumping exercises	Special running segments at competition speed	Maintenance gymnastic complexes
Transition	Light plyometrics (recovery)	Low-intensity cross-country runs	Active recovery and flexibility



Table 2. Distribution of the volumes and intensity of training loads by the periods of the annual cycle

Period of the cycle	Running volume, km/week	Share of low-in tensity loads, %	Share of high-in tensity loads, %	Number of plyo metric sessions per week
Preparatory	150-180	75-80	10-15	1-2
Pre-competition	120-140	60	25-30	2-3
Competition	80-110	50	35-40	1-2
Transition	60-80	85-90	5-10	0

Results of the study and discussion. The theoretical analysis and generalisation of the literary sources made it possible to establish that at the stage of the improvement of sporting mastery the development of the physical qualities of track-and-field runners is most effective with an integral combination of means ensuring the simultaneous improvement of speed-strength abilities and special endurance [2].

The results obtained show that the optimal distribution of loads in the annual cycle presupposes the predominance of long cross-country runs and tempo running in the preparatory period, with the gradual introduction of interval training and plyometric exercises in the pre-competition phase. The data confirm that such a sequence contributes to increasing running economy through an improvement in the power of the push-off and in the coordination of movements, and also minimises the risk of overtraining thanks to strict control of the recovery measures.

An examination of the mechanisms of the adaptation of the body revealed the positive influence of moderate weights and multiple-jump exercises on the development of the strength endurance of the muscles of the legs and trunk, which correlates directly with an improvement in results over the distances of 1500-5000 metres.

The modelling showed the expediency of using variable training (fartlek) to maintain the variability of loads and to prevent monotony, which is necessary for qualified athletes with long training experience. The generalisation of approaches to the individualisation of preparation highlights the need to adjust volumes depending on sex, age and the current level of preparedness. Women demonstrate a greater sensitivity to aerobic loads, and men to speed-strength effects.

The conclusions obtained are consistent with contemporary trends in the construction of the training process and open up prospects for the practical application of the recommendations developed (Table 2) [3, 4].

The analysis demonstrates a gradual reduction in the total volume of running from the preparatory to the competition period, with a simultaneous growth in the share of high-intensity loads. Such a profile makes it possible to preserve the aerobic base at the initial stages and to move towards peak form closer to the main starts [7]. The parameters of the plyometric sessions are selected in such a way as to ensure the development of the power of the push-off without exceeding the recovery capabilities of the body.

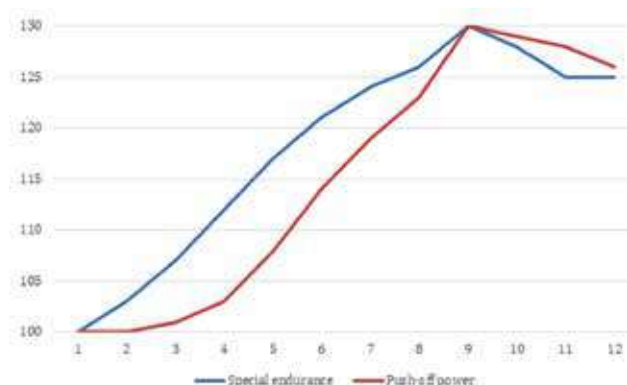


Figure 1. Dynamics of the indicators of special endurance and of the power of the push-off over the course of the annual cycle

The graph reflects the positive dynamics of both indicators throughout the whole annual cycle. Special endurance demonstrates steady growth from the very beginning of the preparatory period and reaches its maximum by the 10th month. The power of the push-off begins to increase actively from the 4th month and reaches its peak simultaneously with endurance, which corresponds to the optimal moment for competitive starts [5].

Conclusions. The methodology of developing the physical qualities of track-and-field runners at the stage of the improvement of sporting mastery that has been developed on the basis of theoretical analy-



sis ensures the harmonious development of speed-strength abilities, special endurance, strength and flexibility within the framework of the annual cycle. The results of the theoretical study obtained confirm the effectiveness of an integral approach with undulating periodisation and the individual distribution of loads, which leads to an increase in running economy and in the stability of competitive results.

The methodology proposed may be recommended for introduction into the practice of preparing qualified runners in sports schools of the Olympic reserve and in national teams, with obligatory monitoring of functional state.

References

1. Minabutdinov S.R., Gibadullin I.G., Kuznetsova Z.M., Nagovitsyn R.S. Variant metodiki razvitiya skorostno-silovykh sposobnostey yunyx legkoatletov. *Pedagogiko-psikhologicheskiye i mediko-biologicheskiye problemy fizicheskoy kultury i sporta*. 2022. V. 17. No. 3. Pp. 51-58.
2. Mosina E.B., Konovalov V.N. Planirovaniye fizicheskoy i tekhnicheskoy podgotovki legkoatletov v godichnom tsikle na uchebno-trenirovochnom etape. *Nauka i sport: sovremennye tendentsii*. 2024. V. 12. No. 4(48). Pp. 119-128.
3. Rakovetskiy A.I., Ponomarev V.V. Sravnitel'naya kharakteristika effektivnosti vozhdeystviya innovatsionnykh programm na fizicheskuyu podgotovlennost studentok vuza. *Teoriya i praktika fizicheskoy kultury*. 2018. No. 9. Pp. 12. EDN: XUAVGH.
4. Smurygina L.V. Metodika podgotovki beguniy massovykh razryadov v bege na 400 metrov. *Fizicheskoye vospitaniye i sport v vysshikh uchebnykh zavedeniyakh*. Belgorod: Belgorodskiy gosudarstvennyy tekhnologicheskiy universitet im. V.G. Shukhova, 2022. Pp. 147-153.
5. Sorokin D.V. Formirovaniye skorostno-silovykh kachestv u begunov sprinterov 14-17 let s ispolzovaniem spetsialnykh utyazheleniy. *Teoriya i praktika fizicheskoy kultury*. 2026. No. 2. Pp. 27-28. EDN: XQJFKW.
6. Khaydarov U.R. Metodika primeneniya spetsialnykh begovykh uprazhneniy, vliyayushchikh na uvelicheniye skorosti sprinterskogo bega. *Problemy i perspektivy razvitiya sportivnogo obrazovaniya, nauki i praktiki*. Moskva: Moskovskiy pedagogicheskiy gosudarstvennyy universitet, 2023. Pp. 246-251.
7. Shuleva E.M., Pronin E.A. Sravnitel'nyy analiz effektivnosti razlichnykh metodov trenirovki begunov na sredniye distantsii bega. *Prioritety razvitiya APK v usloviyakh tsifrovizatsii i strukturnykh izmeneniy natsionalnoy ekonomiki*. Sankt-Peterburg: Sankt-Peterburgskiy gosudarstvennyy agrarnyy universitet, 2023. Pp. 506-509.



Training devices as a tool for the individualisation and for increasing the density of technical preparation in student volleyball

UDC 796.015



A.A. Soparev

Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Moscow

Corresponding author: soparev@rgau-msha.ru

Received by the editorial office on 06.06.2026

Abstract

Objective of the study is to assess the influence of the use of specialised training devices on the technical and tactical indicators and on the final result of a student volleyball team in the competition period.

Methods and structure of the study. The research was conducted within the framework of the educational and training process and of competitive activity over the course of the season from October 2025 to May 2026. Twenty-eight volleyball players took part in the educational experiment: 14 in the experimental group and 14 in the control group. The age of the athletes ranged from 18 to 25 years, with sporting qualifications from Second Category to Candidate for Master of Sport.

Results and conclusions. An analysis of the data obtained in the course of the educational experiment revealed a significant ($p < 0.05$) advantage of the experimental group, which used the training devices, over the control group. The athletes learned to vary the type of serve depending on the game situation, promptly adjusting their tactics on the basis of the data of the 'speed radar' device – this made it possible to raise the coefficient of effectiveness of the power serve and the float serve. A considerable contribution to the growth of effectiveness was made by the use of the 'volleyball cannon': the device made it possible to standardise the speed, trajectory and spin of the ball, which raised the percentage of high-quality reception of the ball in competitive activity. The use of the 'block for technique' device made it possible to improve purposefully the synchronisation of the jump and the accuracy of hand placement when blocking. For the setters, the 'ring for the setter' was of great importance: the accuracy of the overhead and underhand pass into the designated zones increased.

The present methodology ensures the individualisation of preparation through the purposeful correction of weak links on the basis of objective instrumental data.

Keywords: volleyball, training devices, student sport, technical and tactical preparation.

Introduction. Contemporary student volleyball is characterised by increasing competition, a reduction in the time available for preparing for tournaments, and high demands on the stability of technical and tactical actions. Under these conditions, traditional training methods, despite their fundamental importance, often do not make it possible to ensure the necessary density of practice of individual elements. Specialised training devices for volleyball players therefore act as a promising instrument that makes it possible to increase the density of training, to ensure objective monitoring of the parameters of movement and to accelerate the formation of motor skills [2, 5].

The novelty of the present study consists in the empirical verification of the effectiveness of the comprehensive application of training devices of various orientations (from mechanical stabilisers to digital measuring instruments) within the framework of the annual macrocycle of a student team [4, 5]. In contrast to works focusing on individual devices or on short-term experiments, the present study demonstrates the interrelation between the systematic use of equipment in pre-season and competitive preparation and the final statistical indicators in decisive matches [6, 7].

Objective of the study is to assess the influence of the use of specialised training devices on the tech-



nical and tactical indicators and on the final result of a student volleyball team in the competition period.

Methods and structure of the study. The research was conducted within the framework of the educational and training process and of competitive activity over the course of the season from October 2025 to May 2026. Twenty-eight volleyball players took part in the educational experiment, distributed into two groups of 14: the experimental group – a team into whose training process a complex of training devices was integrated – and the control group – a second team that trained by the standard methodology without the use of specialised devices [1].

The age of the athletes varied from 18 to 25 years, and their sporting qualification ranged from Second Sports Category to Candidate for Master of Sport. The criteria of the comparability of the groups were the level of sporting qualification and a length of volleyball training of not less than 5 years.

In the experimental group the devices were applied differentially at all stages of the annual cycle (preparatory, pre-competition and competition) with account taken of the tasks of the microcycles and of the current state of the athletes. The total share of time allocated to work with the devices amounted to 30–40 % of the overall volume of technical preparation in the microcycle [2].

A specialised complex of devices oriented towards the precise development of key game elements was used in the methodology of preparing the volleyball players. The players learned to vary the type of serve flexibly depending on the game situation, promptly adjusting their tactics on the basis of the data of the ‘speed radar’ device [3] – this made it possible to raise the coefficient of effectiveness of the serve to 0.48 through the optimal alternation of float and power serves (Figure 3).

A considerable contribution to the growth of effectiveness was made by the use of the ‘volleyball cannon’: the device ensured the standardisation of the input parameters of reception (the speed, trajectory and spin of the ball), which accelerated the formation of a stable motor skill and raised the percentage of high-quality delivery of the ball under conditions of competitive stress (Figure 2).

The use of the ‘block for technique’ device made it possible to improve purposefully the synchronisation of the jump and the accuracy of hand placement in group blocking. As a result, the effectiveness of the block in the experimental group rose to a coefficient of 0.52, and the number of direct points won by the block almost doubled; in the control group the growth was considerably lower (Figure 4).

A substantial influence on the stability of the setters’ actions was exerted by the ‘ring, or umbrella, for the setter’: work with it contributed to raising the accuracy of the overhead and underhand pass into the designated zones, to stabilising the trajectory of the ball and to reducing the time needed to take a decision under conditions of changing game parameters. In matches this was expressed in a reduction in the number of errors in the second pass and in a growth in the percentage of attacks performed as first-tempo attacks: 0.97 against 0.80 (Figure 4).

The ‘movable block’ training device was designed and manufactured as part of an experimental development by the research group itself, without recourse to external production facilities. Its key purpose is the improvement of the attacking actions of the attacking players: the practice of variants of completing an attack under conditions of opposition from the block (Figure 1).

The systematic application of the complex of devices (volleyball cannon, block for technique, movable

Table 1. Principal means of developing physical qualities by the periods of the annual cycle

Period of the cycle	Speed-strength abilities	Special endurance	Strength and flexibility
Preparatory	Plyometrics (low intensity), multiple jumps	Long cross-country runs, tempo running	Exercises with weights, gymnastic complexes
Pre-competition	Plyometrics (medium and high intensity), running with weights	Interval training, fartlek	Strength exercises of moderate intensity, stretching
Competition	Speed segments, jumping exercises	Special running segments at competition speed	Maintenance gymnastic complexes
Transition	Light plyometrics (recovery)	Low-intensity cross-country runs	Active recovery and flexibility



Movable block



Figure 1.

Volleyball cannon



Figure 2.

Speed radar



Figure 3.

Ring for the setter



Figure 4.

block, radar, jump meter and others) at all stages of the annual cycle of preparation significantly raised the technical and tactical indicators of the team: the percentage of the team's effectiveness in attack increased by 25 %, and the reliability of the serve grew through a reduction in the share of gross errors.

The methodology proposed makes it possible to individualise the training process under the conditions of limited time characteristic of student teams, through the precise correction of deficient links of preparation on the basis of the objective data of instrumental monitoring.

The statistical processing of the data was carried out using a combination of the modified method of V.Ya. Bunin and Student's t-test.

Results of the study and discussion. In the course of an educational experiment lasting 24 weeks, a complex of specialised devices was integrated into the training process of the experimental group – team (n=14): a volleyball cannon, a movable block device, a block for technique, a ring-umbrella for the setter, a speed radar and others. The control group – team (n=14) trained according to the standard programme without the use of instrumental monitoring. The key quantitative results, assessed by the method of V.Ya. Bunin and verified by Student's t-test ($p < 0.05$), are presented below.

Effectiveness of the serve. The coefficient of effectiveness of the serve in the experimental group grew

from 0.40 to 0.49, whereas in the control group the gain amounted to only 0.39 to 0.43. The differences revealed are statistically significant ($t=3.87$, $p < 0.01$). The growth of the indicator in the experimental group is due to the ability formed in the volleyball players to vary the type of serve flexibly (power/float) and to direct the ball purposefully into the zones of maximum pressure on the opponent. This became possible through the integration into the training process of instrumental monitoring and of the practice of tactical decisions under standardised conditions (see the Table).

Effectiveness of the block. The effectiveness of group blocking in the experimental group reached 0.520 ± 0.025 , whereas in the control group the indicator amounted to 0.380 ± 0.030 . The differences between the groups are statistically significant ($t=4.12$; $p < 0.001$), which confirms the effectiveness of the methodology proposed. The use of the 'block for technique' device contributed to the synchronisation of the actions of the blockers, which was directly reflected in game effectiveness. Thus, the number of direct points won by the block in the final game increased in the experimental group: 13 successful blocks were recorded against 6 in the control group (Figure 1, Table).

Attacking hit. In the experimental group the indicator reached a value of 0.78, which reflects a high share of successfully completed attacking actions when using the variable techniques practised on the device.

Table. Statistics and data analysis by the method of V.Ya. Bunin from the final match of the Moscow Student Games 2025-2026

Indicator	Experimental group	Control group
Serve: 1.0 – won; 0.48 – made difficult; 0.35 – simple; 0 – lost.	0.48	0.43
Reception: 0.65 – delivered; 0.55 – ball not delivered, without a first tempo; 0 – ball lost.	0.59	0.55
Attacking hit: 1 – won; 0.47 – kept in play; 0 – lost.	0.78	0.69
Block: W – won.	W – 13	W – 6



In the control group – team the coefficient in attack amounted to 0.69 – also a statistically significant result, confirming the reproducibility of the effect under different conditions of preparation (Table).

Accuracy of the setter's passes. Work with the ring for the setter led to a reduction in the number of errors in the second pass by 37 % and to an increase in the percentage of first-tempo attacks from 28 % to 46 %. Kendall's coefficient of concordance ($W=0.89$) confirmed the high reliability of the expert assessment of the quality of the passes.

The results obtained confirm the effectiveness of the methodology proposed and its potential for practical application in the preparation of volleyball players.

Conclusions. Thus, the results of the study confirm that the application of specialised devices and of the means of instrumental monitoring is an effective instrument for improving the technical and tactical preparation of volleyball players and may serve as a basis for the development of modern training programmes.

The role of instrumental monitoring in the formation of technical skills has been demonstrated; the application of the means of immediate feedback ensured an objective assessment of the parameters of the motor actions and accelerated the formation of stable skills. This was manifested, in particular, in a reduction in the number of errors in the second pass by 37 % and in a growth in the share of first-tempo attacks from 28 % to 46 % through work with the ring-umbrella for the setter.

The approach proposed may be integrated into the training process of student and youth volleyball teams in order to increase the effectiveness of preparation. The methodology makes it possible to act purposefully on the weak aspects of the game and to correct technique and tactical decisions promptly on the basis of the objective data of instrumental monitoring.

References

1. Grigoryev V.A., Markaryan V.S., Dvornikov A.V. Spetsifika podgotovki muzhskikh studentcheskikh sbornykh komand po voleybolu. Fizicheskaya kultura: vospitaniye, obrazovaniye, trenirovka. 2020. No. 4. Pp. 14-16.
2. Leontyeva M.S., Rodin A.V. Formirovaniye dvigatelnykh deystviy v igrovyykh vidakh sporta na osnove trenazhernykh ustroystv. Sportivno-pedagogicheskoye obrazovaniye. 2019. No. 4. Pp. 45-50.
3. Nikiforova O.N., Markin E.V., Soparev A.A. Vliyaniye sovremennykh trenazhernykh ustroystv na uroven fizicheskoy i tekhnicheskoy podgotovlennosti voleybolistov 17-25 let. Teoriya i praktika fizicheskoy kultury. 2025. No. 11. Pp. 101-104.
4. Pustoshilo P.V., Bulykina L.V., Guba V.P. Prime-neniye trenazhernykh ustroystv v protsesse podgotovki studentcheskikh voleybolnykh komand. Nauchnyy vestnik MGUSiT: sport, turizm, gostepriimstvo. 2022. No. 3(73). Pp. 10- 17.
5. Ratov I.P. Issledovaniye sportivnykh dvizheniy i vozmozhnostey upravleniya izmeneniyami ikh kharakteristik s ispolzovaniem tekhnicheskikh sredstv: avtoref. dis. ... dokt. ped. nauk. Moskva, 1972. Pp. 12-28.
6. Skripko A.D. Tekhnologii konditsionnoy i sportivnoy podgotovki v sisteme fizicheskogo vospitaniya uchashchikhsya i studentov: dis. ... dokt. ped. nauk. Moskva, 2004. Pp. 47-59.
7. Tinyukov A.B. Metodika spetsialnoy fizicheskoy i tekhnicheskoy podgotovki kvalifitsirovannykh voleybolistok s ispolzovaniem dopolnitelnogo sportivnogo oborudovaniya: dis. ... kand. ped. nauk. 2019. Pp. 112-117.



Targeted impact on kinematic parameters as a factor in improving the athletic skills of young short-distance runners

UDC 796.422.12



Master student **Feiyi Zhang**¹

Xuesong Bai²

M.S. Kozhedub¹

Postgraduate student **Pan Yuanquan**¹

Dr. Hab., Professor **E.P. Vrublevskiy**¹

¹Francysk Skaryna Gomel State University, Gomel

²Huangshan College of Physical Education, Huangshan

Corresponding author: vru-evg@yandex.ru

Received by the editorial office on 14.05.2026

Abstract

Objective of the study is to substantiate the effectiveness of managing the kinematic parameters of the running technique of young female sprinters.

Methods and structure of the study. Twenty-five female sprinters aged 15–17 years took part in the experiment. In the experimental group (EG, n=13), in contrast to the control group (CG, n=12), the improvement of the athletes' mastery was carried out on the basis of a more purposeful impact on the kinematic parameters of their running technique. The criterion of the effectiveness of the application of the experimental factor was an increase in the speed-strength indicators (the gradient of muscle force and the jumping tests) and a gain in the sporting result in the main distance.

Results and conclusions. The partial correlation coefficients calculated between the running time over a particular segment of the 100 m distance and the relative explosive force of the muscles, as well as the results in the jumping tests, with the statistical exclusion (elimination) of leg length in the athletes, showed that, all other conditions being equal, the advantage in covering the segments of the distance lies with those runners who possess higher indicators of the explosive force of the leg extensor muscles.

The purposeful pedagogical impact in the spring and summer preparatory period on the components of running speed (the length and frequency of the strides), oriented towards the individual features of the athletes, made it possible to raise their speed-strength indicators, which contributed to an improvement in the mean group gain in the 100 m result in the runners of the EG by 0.21 s ($p < 0.05$) in comparison with the previous season. In the athletes of the CG this gain amounted to 0.09 s ($p > 0.05$).

Keywords: short-distance running, female athletes aged 15–17 years, running technique, kinematic characteristics, length and frequency of strides, speed-strength abilities, gradient of muscle force, jumping tests, training effects.

Introduction. The sporting result in all cyclic sporting disciplines (to which running belongs) depends on the average speed achieved over the distance. It is possible to derive a running equation linking two kinematic parameters with horizontal speed. The equation $V_{av} = L_{av} \times F_{av}$ shows that the average running speed is determined by two principal factors: the distance which the athlete covers in each stride, and the frequency with which the legs move. Thus, the runner sets the desired speed by choosing a combination of these two components that is proportionate for her; and in order to run with long strides at a high frequency, the athlete has to develop considerable efforts: first, to overcome external forces, and second,

to displace the links of the body in space so as to ensure the stepping movements [4, 6].

However, in seeking to increase one of the components, the runner may thereby lose in the other. Thus, it might seem possible to bound from foot to foot, increasing the stride length; but a reduction in the frequency of the strides, owing to the increase in the duration of each stride, will lead to a fall in speed. And whereas the demonstration of a particular speed of this form of locomotion requires an indifferent product of stride length and frequency, the magnitude of the latter, for one or another running speed, is decided individually, proceeding from the morphological and physical condition of the athlete.



Using the scheme of J. Hay [7] as an example, let us consider the structure of the interrelation of the characteristics that mainly determine the sporting result in running (Figure). Knowledge of the specific factors conditioning the sporting result in sprint running makes it possible to act upon them for the individually directed improvement of the principal components of running speed – the length and frequency of the strides.

The stride length may conventionally be divided into three separate parts: a) *the distance in the push-off phase* – the amount by which the general centre of body mass (GCBM) of the runner is displaced from the vertical to the moment at which the foot leaves the support; b) *the distance in the flight phase* – the segment covered by the GCBM in flight; c) *the distance in the amortisation phase* – the horizontal distance characterising how far the foot is in front of the projection of the GCBM at landing. As may be seen, the first distance depends mainly on the leg length of the runner, since during running over the distance the push-off angle differs little between runners of the same level of mastery.

As regards that part of the stride length during which the runner is in the flight phase, it depends on the power of the push-off performed by the athlete during the time spent on the support. It should be noted that developing a sufficient impulse of force over the very short period of support – and this is a neces-

sary condition in sprint running – requires considerable muscular effort from the athlete [5, 8].

The magnitude of the third part of the running stride is the smallest of all three, since increasing the stride length by means of this component is undesirable because of the braking effect of the ground reaction force. From the moment the foot is placed on the track the amortisation phase begins, ending at the moment when the downward movement of the body ceases. As a result of the interaction of the athlete with the track, a ground reaction force arises, which depends on the running speed, the body mass of the athlete and the character of her interaction with the support [4]. In order to reduce the ground reaction force, the high-class athlete pulls the toes towards herself before placing the foot on the track (dorsiflexion of the foot), creating tension in the soleus muscle and the Achilles tendon, which contributes to a reduction in the horizontal ‘landing’ speed of the foot [2, 8].

The frequency of the strides, in turn, depends on the duration of the running stride, which includes the time of the support and non-support phases. This means that an increase in the frequency of the strides occurs through a reduction in the duration of contact of the foot with the track and a decrease in the time spent in flight.

Objective of the study is to substantiate the effectiveness of managing the kinematic parameters of

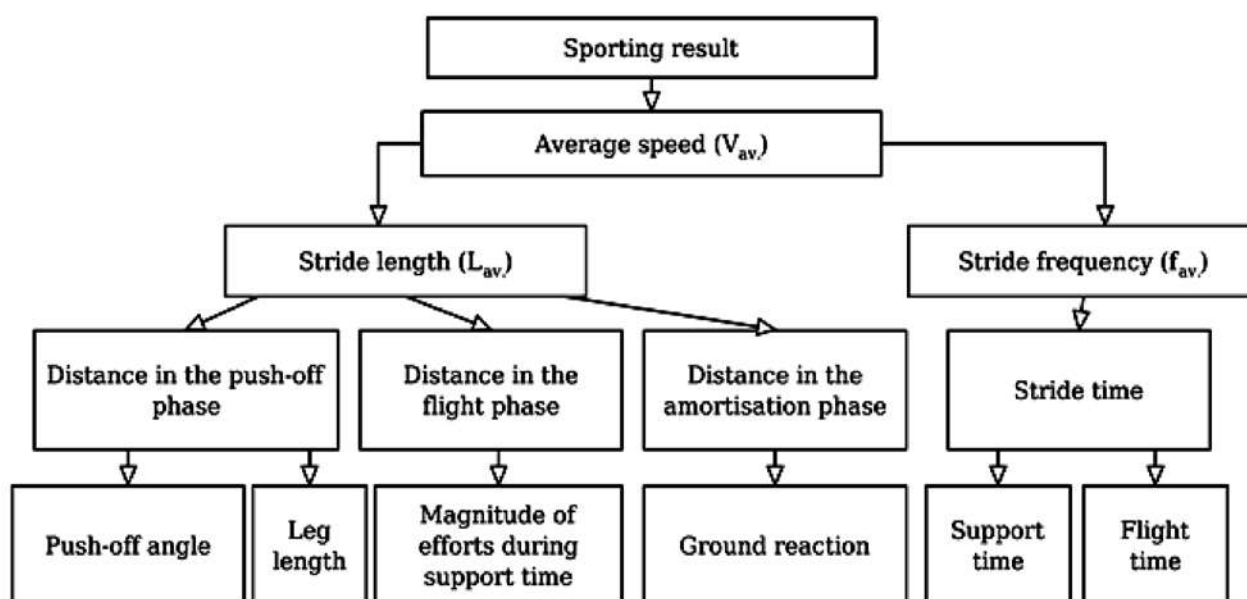


Figure. Interrelation of the factors conditioning the sporting result in running



the running technique (the length and frequency of the strides) of young female sprinters.

Methods and structure of the study. Twenty-five female sprinters aged 15–17 years, whose range of results in the 100 m run was from 12.11 to 13.02 s, took part in the experiment, which was conducted in the spring and summer preparatory period.

In the experimental group (EG, $n=13$), in contrast to the control group (CG, $n=12$), the improvement of the athletes' mastery was carried out on the basis of a more purposeful impact on the kinematic parameters of their running technique. The criterion of the effectiveness of the application of the experimental factor was an increase in the speed-strength indicators (the gradient of muscle force and the jumping tests) and a gain in the sporting result in the main distance. In order to assess the speed-strength capabilities of the leg extensor muscles in the athletes, a differential indicator (gradient) of force (I) was calculated, characterising the rate of its increase to maximum ($I = F_{\max}/t_{\max}$), together with its magnitude relative to the body mass of the athletes.

Results of the study and discussion. Taking into account the fact that the magnitude of the stride length and the number of strides over the sections of the sprint distance are influenced by anthropometric parameters, and in order to exclude this influence statistically, the partial correlation coefficient was applied. The latter makes it possible to assess the interrelation of two characteristics with the exclusion (elimination) of the influence of a third indicator upon it [1]. In this way it is possible to establish what the interrelation between the time of covering one or another section of the 100 m distance and the indicators of special strength preparedness would be if the leg length of all the athletes were the same.

The partial correlation coefficients calculated between the running time over a particular segment of the distance and the relative explosive force of the muscles (the I -gradient of the leg extensors at the knee and hip joints), as well as the results in the standing triple jump and the standing ten-fold jump, with the elimination of leg length in the athletes, showed that, all other conditions being equal, the advantage in covering the segments of the distance lies with those runners who possess higher indicators of the explosive force of the leg extensor muscles.

In each particular case, an improvement in results in sprint running may be achieved by increasing one or both of the kinematic parameters, or by decreas-

ing one parameter and increasing (more substantially) the other. Therefore, in the course of the educational experiment it was necessary, in order to increase the running speed of the young athletes, to act purposefully upon the length and frequency of their running stride.

To increase the length of the running stride, the following exercises were mainly used: 1. *Running over markings exceeding the stride length by 3–5 cm.*

2. *Increasing the strength capabilities of the hip extensor muscles.*

3. *Running with cuffs fixed to the distal ends of the shin (weight 150–250 g) and to the thigh (weight 300–400 g).* The use of this exercise is connected with the fact that the increased weight of the shin creates greater moments of inertia of the moving link and allows the athlete to 'feel' the displacement of the shin, as well as to apply efforts more successfully when performing the swing of the lower limb.

To increase the frequency of the running strides, the following exercises were mainly used: 1. *Running over markings with a slight reduction in stride length.*

2. *Jumping exercises differing in the method of performance and in distance, with the time of performance recorded.*

3. *Increasing the strength capabilities of the flexor muscles of the legs and trunk.*

4. *Running under facilitated conditions. For this purpose a track with a slight (3–5°) incline was used.*

At the same time, attention was focused on the fact that the stride length should increase not through the 'flicking out' of the shin when the foot is placed on the track, but through more effective propulsion in the support phase of the stride. In turn, in order to increase the running tempo the athletes had to place the emphasis on the frequency of the arm action, to bring the thighs together energetically, and to seek to reduce the time of support and of flight.

'Short' jumping exercises were widely used in training: the long jump, the triple jump, and the five-fold jump from foot to foot and on one leg. In choosing these exercises we proceeded from the available evidence that 'short' jumps contribute to the development of the explosive force of the leg muscles and predominantly influence the development of the capacity for starting acceleration [5]. In turn, 'long' jumping exercises (multiple push-offs with one leg or from foot to foot over segments of 30–50 m) contribute to a greater degree to increasing maximum running speed and speed-strength endurance. The combination of



'short' and 'long' jumping exercises leads to the summation of their training effect and to the development of the speed-strength abilities specific to sprinters [4, 5].

Strength exercises with weights were applied with the aim of a directed impact on the principal muscle groups of the lower limbs; the starting position in these was predominantly chosen in such a way as to ensure muscular efforts at those joint angles which correspond to the accentuated section of the working amplitude in high-speed running. For the conjugate improvement of motor qualities and technical mastery, running under impeded and facilitated conditions was used, which stimulated an increase in stride length (after impediment) or in frequency (after facilitation). The ratio of runs under impeded, facilitated and normal conditions that was trialled amounted, respectively, to 1:1:1 or 1:2:2.

The purposeful training effects in the spring and summer preparatory period on the kinematic parameters (the length and frequency of the strides) of the athletes' running technique, oriented towards their individual features, made it possible to raise the speed-strength indicators of the athletes, which contributed to an improvement in the mean group gain in the 100 m result in the runners of the EG by 0.21 s ($p < 0.05$) in comparison with the previous season. In the athletes of the CG this gain amounted to 0.09 s ($p > 0.05$).

Conclusions. In addressing the task of increasing running speed, it is first of all necessary to determine which of the two components of speed – length or frequency – should be increased, and what optimal ratio of the two will give the required gain in speed for the particular athlete. It is important in doing so to establish which aspects of physical preparedness limit

the development of the speed parameters, which will make it possible to draw up a programme of individual correction of the training process [3]. It should be emphasised that the finer the runner's ability to manage the motor components influencing running speed, and to change their magnitudes at the required moment and to the appropriate degree, the more perfect her sporting mastery.

References

1. Glass J., Stanley J. Statisticheskiye metody v pedagogike i psikhologii: per. s angl. Moskva: Progress, 1976. 475 p.
2. Kryazhev V.D. Sovershenstvovaniye begovykh dvizheniy. Moskva: Izd-vo VNIIFK, 2002. 191 p.
3. Li Xinhao, Liu Tianyun, Kozhedub M.S., Vrublevskiy E.P. Individualnye aspekty sorevnovatelnoy deyatelnosti yunikh beguniy na korotkie distantzii. Teoriya i praktika fizicheskoy kultury. 2026. No. 7. Pp. 19-22.
4. Nauka i sport: sb. obzornykh statey [per. s angl.]. pod red. V.M. Zatsiorskogo, G.S. Tumanyana. Moskva: Progress, 1982. 272 p.
5. Ozolin E.S. Sprinterskiy beg. Moskva: Fizkultura i sport, 1986. 159 p.
6. Tyupa V.V., Turaev V.T. Beg s maksimalnoy skorostyu: monografiya. Moskva: TVT Divizion, 2020. 234 p.
7. Hay J.G. The Biomechanics of Sports Techniques. Englewood Cliffs, N.J.: Prentice-Hall, 1978. Pp. 110-115.
8. Mann R., Harman I. Kinematic analysis of Olympic sprint performance. International Journal of Sport Biomechanics. 1985. No. 1. Pp. 151-162.



The effectiveness of the use of figurative And model didactic tools in technical training of young hockey players

UDC 796.012



Dr. Hab., Professor **L.I. Lubysheva**¹

Postgraduate student **A.V. Belyaev**²

¹The Russian University of Sport «GTSOLIFK», Moscow

²Nizhnevartovsk State University, Nizhnevartovsk

Corresponding author: belyaevugra98@yandex.ru

Received by the editorial office on 24.07.2026

Abstract

Objective of the study is to theoretically substantiate and experimentally test the effectiveness of integrating figurative (metaphorical) and model didactic tools into the process of technical training of hockey players aged 6-7 years to optimize the formation of the sensorimotor structure of movements.

Methods and structure of the study. The pedagogical experiment was conducted on the basis of sports schools in Khanty-Mansiysk Autonomous Okrug-Yugra (Olympic Reserve Sports School "Samotlor", Nizhnevartovsk - control group; sports school "Yugra", Khanty-Mansiysk - experimental group. The sample consisted of 85 children aged 6-7 years. Classes were held 6 times a week for 60 minutes during the school year.

Results and conclusions. According to the results of the pedagogical experiment, statistically significant changes were revealed in all indicators of special physical and technical fitness of young athletes from the experimental group. The conducted research confirms the high effectiveness of the use of figurative and model didactic tools in the technical training of young hockey players.

Keywords: *young hockey players, children 6-7 years old, technical training, figurative means, metaphors, model means, visual-imaginative thinking, pedagogical experiment, skating technique.*

Introduction. The sports system of the Russian Federation is characterized by a growing focus on early identification and targeted training of talented children in key sports, including ice hockey, one of the national sports that traditionally shapes the country's sporting potential. Modern hockey is characterized by an increasing intensity and dynamism of game processes, which places increased demands on the technical readiness of players from the earliest stages of sports specialization. It is known that the age of 6-7 years is optimal for mastering basic motor skills, when neuromuscular connections are formed, spatial orientation and the ability to imitate develop.

Experts pay attention to the need to take into account the basic patterns of growth and development of children and adolescents, their state of health and the characteristics of motor fitness when choosing pedagogical methods of influencing the student's body, depending on the specific tasks of the educational process [2, 4, 5]. According to experts, one of

the most effective pedagogical techniques for children aged 6-7 years, which allows laying the foundation for the formation of technical skills, is the use of figurative (metaphorical) and model (visual, subject, game) didactic means, which makes it possible to transform complex motor actions into understandable, emotionally saturated and easily digestible structures [1, 3].

The above is consistent with the strategic priorities of the policy in the field of physical education and sports, aimed at improving the effectiveness of children's sports schools and retaining children in sports at an early stage. Thus, the integration of figurative and model didactic tools into the process of technical training of young hockey players acquires a high scientific and methodological significance, since their use makes it possible to optimize the formation of the sensorimotor structure of movements in children aged 6-7 years, taking into account the dominance of visual- an imaginative type of thinking, which ensures not only the intensification of the learning process of the



basic elements of technology, but also contributes to the formation of a variable motor skill that is resistant to the effects of disruptive factors of gaming activity.

Objective of the study is to theoretically substantiate and experimentally test the effectiveness of integrating figurative (metaphorical) and model didactic tools into the process of technical training of hockey players aged 6-7 years to optimize the formation of the sensorimotor structure of movements.

Methods and structure of the study. The pedagogical experiment was conducted on the basis of sports schools in Khanty-Mansiysk Autonomous Okrug-Yugra (Olympic Reserve Sports School "Samotlor", Nizhnevartovsk - control group; sports school "Yugra", Khanty-Mansiysk - experimental group. The sample consisted of 85 children aged 6-7 years. Classes were held 6 times a week for 60 minutes during the school year.

The use of figurative and model didactic tools in the technical training of young hockey players in the

experimental group was carried out through the "spiral of technical growth" algorithm, where the improvement of technique does not occur linearly, but through repeated cycles. Young hockey players first mastered movement at the same level, then due to the complication of the conditions of performance or increased variability, the technique temporarily deteriorated ("broke"), after which it stabilized again and reached a higher level of quality. The training of technical elements took place in 4 stages: - the stage of perception (visual model).

At this stage, it was planned to demonstrate a video model of a reference technique or 3D animation, when a young hockey player had to see the external "geometry" of movement. A demonstration of the pro video model was also used, followed by its comparison with a simplified image. - the association stage (stimulus image). Accompanying a visual model with a verbal metaphor that evokes a tactile or motor response that is understandable to the child. The exercise was ac-

Table 1. Indicators of special physical and technical fitness of children aged 6-7 years (the control group, n=40) and (the experimental group, n=45) before and after the pedagogical experiment

Indicators		The experiment period		tp
		Before	A	
		$\bar{X} \pm \sigma$	$\bar{X} \pm \sigma$	
Ice skating 20 m, sec	EG	5,4±0,2	4,4±0,3	12,56**
	KG	5,3±0,3	4,8±0,3	6,74**
	tp	1,83	6,14**	
Ice skating 20 m back-wards, sec	EG	7,8±0,7	6,6±0,5	3,16**
	KG	7,5±0,8	7,2±1,3	1,94
	tp	1,84	2,87*	
Ice skating Slalom with puck driving, sec	EG	16,6±1,4	15,2±0,9	2,43*
	KG	16,5±1,3	15,9±1,2	1,77
	tp	0,34	3,06**	
Ice skating slalom without puck, sec	EG	13,9±1,1	13,2±0,9	2,08*
	KG	14,1±1,0	13,4±0,8	2,17*
	tp	0,87	1,08	
Shuttle skating 6x9 m,, sec	EG	17,6±1,5	16,3±0,7	2,63*
	KG	17,4±1,6	16,8±1,4	1,95
	tp	0,59	2,12*	
Tracing 3 posts followed by throwing the puck into the goal, sec	EG	11,5±1,2	10,6±0,7	2,57*
	KG	11,4±1,3	11,0±1,1	1,49
	tp	0,37	2,02*	

Note: * – statistically significant difference in the average group values of the indicator at $\alpha=0.05$; ** – statistically significant difference in the average group values of the indicator at $\alpha=0.01$; $t_{cr}=1.99$ is the critical value of the Student's criterion for related samples at $n=40$ with a significance level of 0.05 and $t_{cr}=2.64$ with a significance level of 0.01; $t_{cr}=1.98$ is the critical value of the Student's criterion for related samples at $n=45$ with a significance level of 0.05 and $t_{cr}=2.63$ with significance level $\alpha=0.01$; $t_{cr}=1.99$ – critical the value of the Student's criterion for unrelated samples at $n=40$ and $n=45$ with a significance level of 0.05 and $t_{cr}=2.64$ with a significance level of 0.01.



accompanied by the use of model tools that define spatial boundaries. - the stage of ideomotor training. Young hockey players were asked to mentally reproduce an image before performing a certain motor action lasting 30-45 seconds. The child closed his eyes and imagined kinetic sensations from the metaphor ("hands are soft like plasticine"). - the implementation stage was associated with the implementation of an exercise with an emphasis on a key guideline, that is, moving away from external models to an internal image.

The young hockey player performed an action in a game situation, keeping in mind only the key metaphor-a hint. When performing the exercises, the principle of "Tell – Show – Let me try" was applied: first, an image (metaphor) was voiced by the coach - teacher, then a "model" of performance was demonstrated, after which the athlete copied exactly the given semantic image, and not a technical drawing. For children aged 6-7, it is especially important that mistakes are corrected not through a harsh indication of a flaw, but through an image, a short instruction, and a repeat screening. The combination of verbal guidance, demonstration, and sensory cues worked most effectively: "feel the ice," "hold the puck close," "look at the target," "stop gently." This approach allowed us to form not only motor techniques, but also a conscious movement pattern, as well as self-control skills for performing motor actions.

Results of the study and discussion. To test the effectiveness of the use of figurative and model tools in the technical training of young hockey players, a pedagogical experiment was conducted in which 85 children aged 6-7 participated. During the pedagogical experiment, measurements of indicators characterizing the special physical and technical readiness of children aged 6-7 (on ice hockey grounds) were carried out: 20 m speed skating, 20 m backstroke skating, slalom ice skating with puck, slalom ice skating without a puck, 6x9 shuttle run, 3-post stroke followed by a puck throw into the goal. Table 1 shows the results of indicators of special physical and technical fitness of children aged 6-7 years before and after the experiment.

According to the results of the pedagogical experiment, statistically significant changes were revealed in all indicators of special physical and technical fitness of young EG athletes.

The most significant increases in athletes in this group occurred in terms of indicators characterizing the level of development: special speed qualities and face-forward skating techniques – 19% (at $\alpha=0.01$), coordination abilities, special speed qualities and back-forward skating techniques – 15% (at $\alpha=0.01$), coordination abilities, maneuverable skating techniques and the technique of using the stick, the technique of leading, circling and finishing the puck

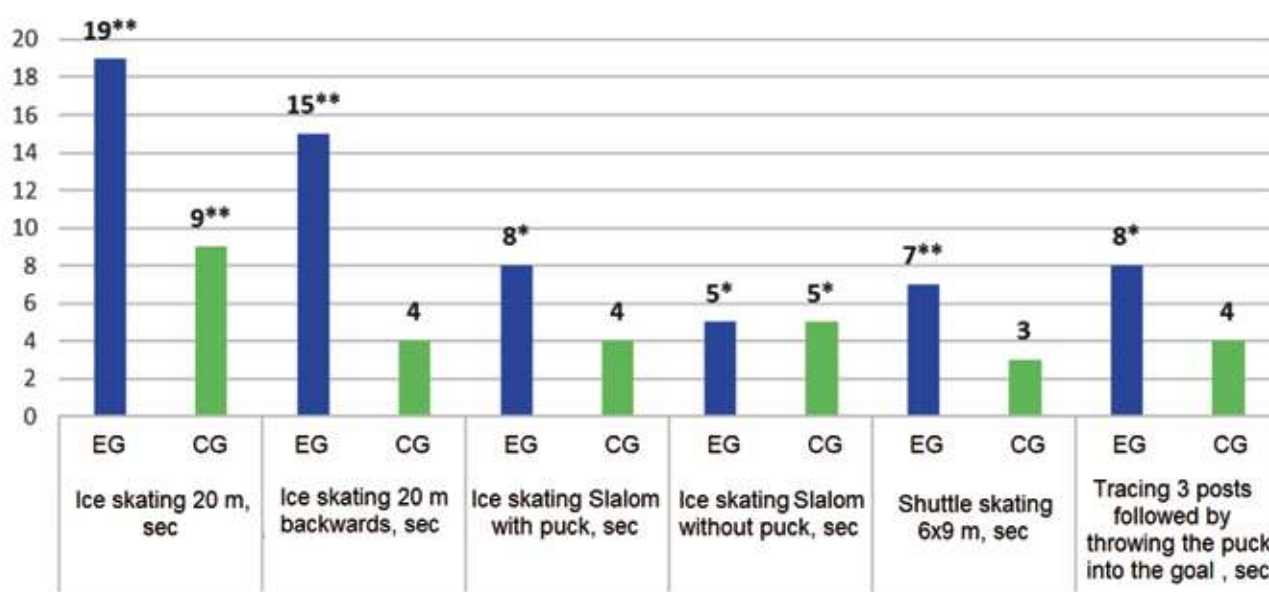


Figure 1. Increases in indicators of special physical and technical physical fitness of children aged 6-7 years KG and EG at the end of the pedagogical experiment, %.



into the goal – 8% (at $\alpha = 0.05$). While the young KG hockey players had statistically significant changes in only 2 of the 6 indicators of special physical and technical fitness: 20 m speed skating, slalom speed skating without a puck. The greatest statistically significant increase in athletes in this group occurred in terms of the indicator characterizing the level of development of special speed qualities and face-forward skating technique - 9% (at $\alpha=0.01$).

Conclusions. The conducted research confirms the high effectiveness of the use of figurative and model didactic tools in the technical training of young hockey players. The integration of visual models, verbal metaphors, and the principles of ideomotor training optimizes the formation of basic motor skills in children aged 6-7 by matching their leading type of thinking. A comparative analysis of the results of the pedagogical experiment revealed a significant advantage of the experimental group over the control group in key indicators of technical training. The greatest increase was demonstrated by special speed qualities and skating technique (up to 19%), as well as coordination abilities when moving backwards (15%).

In the control group, where the training was conducted using traditional methods of direct display and repeated repetition without deep semantic study of the image of movement, statistically significant changes occurred in only two of the six tests. The use of the "spiral of technical growth" algorithm, which assumes a controlled temporary deterioration of technology in order to reach a new qualitative level, made it possi-

ble to form not just an automated stereotype of movement, but a conscious scheme of action. This makes the acquired skills more flexible and resistant to game stress. Thus, the use of a set of didactic tools and work through sensory prompts is an effective tool for keeping children in sports, preventing the monotony of the educational and training process and laying the foundation for high technical skills at the sports and recreation stage of training.

References

1. Aksarina I.Y., Aksarin I.V., Boryakin K.Y. Features of technical training of young hockey players aged 7-8 years using training devices. Eurasian Scientific Association. 2019. No. 10-6(56). Pp. 452-455.
2. Arkhipov, D. D. Skating as the most important element of the technical training of young hockey players. Successes of modern natural science. 2013. No. 10. Pp. 54.
3. Belyaev A.V. The use of summing exercises to improve the effectiveness of technical training of hockey players aged 8-9. Physical culture: upbringing, education, training. 2023. No. 3. Pp. 58-59.
4. Guba V.P., Kvashuk P.V., Nikitushkin V.G. Individualization of training for young athletes. Moscow: Physical culture and sport, 2014. 280 p.
5. National Hockey Player Training Program: philosophy and basic principles. Moscow: Proshvchenie Publ., 2018. 60 p.



Values, mental skills and competitive reliability in athletes with different levels of hardiness

UDC 159.9.072.42



PhD, Associate Professor **A.E. Lovyagina**¹

E.A. Gurvich¹

V.M. Sheloumova¹

¹Saint-Petersburg State University, Saint Petersburg

Corresponding author: lovagina2@mail.ru

Received by the editorial office on 23.06.2026 r.

Abstract

Objective of the study is to examine the hardiness of athletes in relation to their values, mental skills and competitive reliability.

Methods and structure of the study. A psychodiagnostic examination of athletes engaged in various sports (n=252) was conducted using instruments assessing the components of hardiness, values, mental skills and competitive mental reliability.

Results and conclusions. At a high level of the components of hardiness and of its overall level, athletes display more pronounced values of self-development, achievement, patriotism and others, and better-developed mental skills: hard work, mobilisation, distraction control and others. An increase in commitment, control and the level of hardiness has a positive effect on the competitive reliability of athletes, whereas an increase in risk-taking is associated both with its improvement (stability of technique) and with its deterioration (emotional stability, motivation).

Keywords: *hardiness, values, mental skills, competitive mental reliability.*

Introduction. In contemporary psychology, hardiness is interpreted as a system of stable personal beliefs that makes it possible to cope successfully with the difficulties of stressful situations and comprises three components: commitment, control and risk-taking [2, 7]. In recent years the phenomenon of hardiness has been actively investigated by sports psychologists: differences in its development have been identified between athletes and persons not engaged in sport, and links with certain behavioural characteristics have been established [3, 4, 6]. In the opinion of Russian and foreign specialists, it is legitimate to regard hardiness as a quality that has a positive influence on success in sports participation, and sporting activity as an environment conducive to the formation of this property [1, 3, 4, 5, 6]. Despite the growing interest of researchers in the study of hardiness, its links with the qualities necessary for a successful sporting career – values, mental skills and the properties of competitive reliability – have not yet been sufficiently specified, which does not allow hardiness to be fully taken into account in psychological support.

Objective of the study is to examine the hardiness of athletes in relation to their values, mental skills and competitive reliability.

Methods and structure of the study. The sample consisted of athletes from sports clubs in Saint Petersburg, the Leningrad Oblast and Ekaterinburg (n=252; 82 men, 170 women; aged 17–25 years) engaged in athletics, swimming, cross-country skiing, speed skating, figure skating, artistic and rhythmic gymnastics, boxing, sambo, judo, climbing and orienteering, and holding sporting qualifications ranging from first adult category to international-class master of sport. The following instruments were used for the psychodiagnostic examination of the athletes: the hardiness test of S.R. Maddi in the adaptation of D.A. Leontiev and E.I. Rasskazova [2]; the test of life values of V.F. Sopov and L.V. Karpushina; the questionnaire 'My Patriotism' by S.N. Kipreev; the Ottawa Mental Skills Assessment Tool of N. Durand-Bush, J.H. Salmela and I. Green-Demers in the adaptation of K.A. Bochaver, L.M. Dovzhik and M.D. Balakshina; and the question-



Table 1. Interrelations between the components of hardiness and the values of athletes (correlation analysis, Spearman's test, $n=120$)

Values	Commitment	Risk-taking	Hardiness
Self-development	Not significant	$r=0.217, p=0.017$	Not significant
Creativity		Not significant	$r=0.548, p=0.000$
Spiritual satisfaction			$r=0.989, p=0.000$
Achievement of success	$r=0.239, p=0.008$		Not significant
Preservation of one's individuality	Not significant		$r=0.470, p=0.000$
Patriotism	$r=0.482, p=0.000$		Not significant

naire 'Mental Reliability of the Athlete' by V.E. Milman. The examination was carried out in 2024–2026 during training periods, when the athletes had no competitions and the training load was moderate.

Results of the study and discussion. The overall level of hardiness and the degree to which its components (commitment, control, risk-taking) are expressed in athletes lie in the range from average to above-average values. No statistically significant differences in the hardiness indicators of athletes of different sexes were identified. An increase in commitment, which characterises active involvement in activity, is interrelated with a growth in the values of achieving results and of patriotism (Table 1). A strengthening of athletes' conviction that any experience will be of benefit to them (risk-taking) is interrelated with a higher level of the value of self-development. A rise in the overall level of hardiness is interrelated with an increase in the values of creative search and the possibility of changing oneself and one's life (creativity), of spiritual satisfaction and of preserving one's individuality (Table 1).

An analysis of the results presented above shows that athletes with higher hardiness indicators are better prepared to accept the social and economic changes taking place in sport and in life; they assess the experience they have gained more positively, are ready to try new things, and are oriented towards self-improvement. In the current situation, in which the pressure of international sanctions against Russian

sport persists in a number of sports, it is particularly important that a higher level of athletes' commitment is accompanied by a strengthening of the sense of patriotism – the acceptance of the spiritual and moral values of one's country and adherence to patriotic reference points in behaviour.

Differences were identified in certain mental skills in athletes with different levels of commitment and control (Table 2). The levels of the hardiness components were recorded in accordance with the norms of the authors of the instrument [2]. In comparison with athletes with a low and average level of commitment, athletes with a higher level are more hard-working and more persistent in achieving the goals of their sports participation; in difficult, sport-relevant situations they mobilise better, act more consciously and rationally (planning), and control their attention more successfully when exposed to distracting factors. The lowest development of hard work, distraction control and planning is demonstrated not by athletes with a low but by those with an average level of commitment, which indicates the ambiguous dependence of mental skills on this component of hardiness. Similarly, the ability to evoke a vivid image of victory and the corresponding images of forthcoming actions (imagery) is better developed in athletes with an average rather than a high level of control (Table 2).

All the components of competitive reliability differ depending on one or another indicator of hardiness

Table 2. Mental skills in athletes with different levels of the components of hardiness (Kruskal–Wallis H test, $n=132$)

Mental skills	Hardiness indicators	Mean rank at different levels			H	p
		Low	Medium	High		
Hard work	Commitment	63.69	59.21	79.4	6.692	0.035
Mobilisation	Commitment	58.73	62.07	80.4	7.509	0.023
Distraction control	Commitment	65.23	58.56	78.77	6.415	0.040
Planning	Commitment	61.51	59.56	81.1	8.218	0.016
Imagery	Control	55.96	75.47	73.58	7.744	0.021



Table 3. Components of competitive reliability in athletes with different levels of the hardiness indicators (Kruskal–Wallis H test, $n=132$)

Components of competitive reliability	Hardiness indicators	Mean rank at different levels			H	p
		Low	Medium	High		
Emotional stability	Commitment	52.06	68.68	77.92	9.261	0.010
	Risk-taking	77.91	63.16	56.91	6.891	0.032
Competitive self-regulation	Control	33.38	71.50	111.32	96.032	0.000
	Overall level	45.87	61.99	96.96	34.517	0.000
Motivation to compete	Commitment	23.41	68.87	106.31	92.603	0.000
	Risk-taking	80.36	69.24	46.26	17.043	0.000
	Overall level	52.06	71.36	74.53	8.092	0.017
Stability	Risk-taking	25.28	75.65	104.84	95.674	0.000
	Overall level	60.12	59.25	85.63	12.092	0.002

(Table 3). The highest emotional stability in competition is displayed by athletes inclined to become actively involved in a variety of situations (commitment) but not prepared to take risks (a low level of risk-taking). During competition, the athletes who manage themselves best (sporting self-regulation) are those with high control and a high overall level of hardiness. Motivation to compete is higher in athletes with high commitment and a high overall level of hardiness, as well as with low risk-taking. More stable technique and behaviour in competition are demonstrated by athletes with high risk-taking and a high overall level of hardiness (Table 3).

Commitment acts as a predictor of the motivation to compete (multiple regression analysis, $\beta=1.207$; $p=0.007$), and risk-taking as a predictor of the stability of technique and behaviour (multiple regression analysis, $\beta=0.582$; $p=0.022$). Evidently, athletes who become actively involved in various life situations, including competitive ones, and who are prepared to accept not only positive but also negative experience, worry less in competition and feel more confident. This contributes to a strengthening of the desire to compete and makes it possible to stabilise the technique of competitive exercises.

Conclusions. With higher commitment, athletes display more pronounced values of achieving success and of patriotism, better-developed mental skills (hard work, mobilisation, distraction control and planning), and higher competitive emotional stability and desire to compete. Athletes with a higher level of control possess better-developed imagery and regulate their behaviour and state in competition more effectively. In athletes with a higher level of risk-taking, the value of self-development is more pronounced, while emotional stability and the desire to compete are poorer but the stability of technique in competition is better. With a higher overall level of hardiness, the values of

creativity, spiritual satisfaction and the preservation of individuality are higher, and competitive self-regulation and the stability of technique are also better. The results obtained may be used for the individualisation of the psychological support of athletes.

References

1. Bayer E.A., Gonchar O.A. Zhiznestoykost kak bazovoe kachestvo formirovaniya sportsmenov (na primere uchilishcha olimpiyskogo rezerva). Teoriya i praktika fizicheskoy kultury. 2023. No. 8. Pp. 40-41.
2. Leontiev D.A., Rasskazova E.I. Zhiznestoykost i ee diagnostika. Moskva: Smysl, 2019. 159 p.
3. Lovyagina A.E., Ilyina N.L., Lukina S.M., Shindrikova E.V. Psikhicheskaya samoregulyatsiya i realizatsiya podgotovlennosti na sorevnovaniyakh u sportsmenov s raznym urovnem zhiznestoykosti. Teoriya i praktika fizicheskoy kultury. 2023. No. 9. Pp. 35-36.
4. Rogaleva L.N., Shtokolok V.S., Shurmanov E.A., Dubinkina Yu.A. Vliyanie sporta na razvitie zhiznestoykosti podrostkov Aktualnye voprosy sportivnoy psikhologii i pedagogiki. 2022. V. 2. No. 1. Pp. 60-72.
5. Das A., Seema N. Impact of Psychological Hardiness and Sports Motivation on the Well-Being of Sportspersons. Technological Innovation and Enhancing Decision Processes in Modern Enterprises. 2026. V. 631. Pp. 1005-1016.
6. Carbajal P.N., Ramirez R., Medina-Villanueva S., Ródenas L. Hardiness and social context in young university athletes. Journal of Social Researches. 2025. No. 11. Pp. 135-142.
7. Maddi S.R. Hardiness: The courage to grow from stresses. The Journal of Positive Psychology. 2006. V. 1. Pp. 160-168.



The use of crossfit in the system of physical training of special unit personnel

UDC 796.011



PhD, Associate Professor **Yu.V. Smirnova**¹

Dr. Hab., Professor **E.G. Saykina**²

Dr. Hab., Professor **V.E. Smirnov**³

Dr. Hab., Professor **P.V. Stankevich**²

¹Pushkin Leningrad State University, Saint Petersburg

²The Herzen State Pedagogical University of Russia, Saint Petersburg

³Russian State University of Justice named after V.M. Lebedev, Saint Petersburg

Corresponding author: yul197252@ya.ru

Received by the editorial office on 15.06.2026

Abstract

Objective of the study is to develop and experimentally verify the effectiveness of a model of the physical preparation of special unit personnel with the use of the means of CrossFit, aimed at developing the physical abilities that are of priority for this target group and that ensure the successful performance of service tasks in modern conditions.

Methods and structure of the study. In the course of the study, modelling, an educational experiment and pedagogical testing aimed at assessing the physical fitness of the personnel were used.

Results and conclusions. The authors have developed a model of the physical preparation of special unit personnel with the use of the means of CrossFit, aimed at developing the physical abilities that are of priority for this target group and that ensure the successful performance of service tasks in modern conditions. The results obtained in the educational experiment confirm its effectiveness for the development of general and special (speed-strength and coordination) endurance, speed, strength and flexibility.

Keywords: professionally applied physical preparation, extreme conditions, priority physical abilities, model of physical preparation, CrossFit.

Introduction. The contemporary geopolitical situation is distinguished by the high dynamics of the transformation of threats and places increased demands on the professional preparation of the personnel of law enforcement and security agencies [1, 4].

It should be noted that traditional physical training programmes are conservative and standards-oriented in nature and do not sufficiently develop special endurance, adaptation to high-intensity loads and the capacity for rapid recovery [2, 3].

The above determines the need to introduce high-intensity methods that model loads approximating to extreme conditions [4].

A promising direction for overcoming this problem is the adaptation of CrossFit for the physical preparation of special unit personnel.

Objective of the study is to develop and experimentally verify the effectiveness of a model of the

physical preparation of special unit personnel with the use of the means of CrossFit, aimed at developing the physical abilities that are of priority for this target group and that ensure the successful performance of service tasks in modern conditions.

Methods and structure of the study. In the course of the study, modelling, an educational experiment and pedagogical testing aimed at assessing the physical fitness of the personnel were used.

The model comprises three blocks: the conceptual block, the organisational and content block, and the outcome block.

The conceptual block defines:

The aim: raising the level of physical fitness and stress resistance;

The tasks: the development of the adaptive capacities of the body, of strength and coordination abilities, of speed of reaction, of speed qualities, of strength flexibility, and of general and special endurance;



The principles: general pedagogical (systematic character, consistency, progression, conscious involvement, activity, scientific soundness, durability, visual presentation), specific (the gradual build-up of loads, the systematic alternation of load and rest, conscious sensory control) and special (the military-applied orientation of the exercises, the unity of physical and other types of preparation – firearms and tactical-special – the optimal ratio of volume and intensity, diagnostics and correction).

The organisational and content block is represented by four consecutive cycles with a total duration of 3.5 months:

1. The introductory and instructional cycle (1 month) – assessment of the initial level, mastery of the technique of the basic CrossFit exercises, preparation for the high-intensity regime, the formation of 'motor literacy' and injury prevention.

2. The volume and development cycle (1 month) – an increase in training volume, the consolidation of technique, an increase in general and special working capacity, work with weights of 70–80 % of the repetition maximum.

3. The high-intensity cycle (1 month) – attainment of peak intensity, work at the limit of capability, the use of maximum weights and of the AFAP and AMRAP formats, the modelling of stressful situations for the development of physical qualities and psychological resilience.

4. The recovery cycle (2 weeks) – a reduction in volume and intensity, the provision of supercompensation, final testing.

Each training session within the model had a three-part structure:

The preparatory part (special warm-up) – low-intensity cardio, dynamic mobilisation of the joints, neuromuscular tuning (imitation of technical elements).

The main part – two blocks: the strength block (maximum and explosive strength: work at 85–100 % of 1RM for 1–3 repetitions, dynamic efforts at 50–70 % for 8–10 repetitions, gymnastic elements) and the

conditioning block (the development of mixed endurance – the EMOM, AFAP and AMRAP formats).

The concluding part – the development of flexibility and of the strength of the trunk muscles (the core), low-intensity activity for the elimination of lactate and the normalisation of the heart rhythm.

Such a structure ensures the integrity of the training process, in which each stage prepares the body for the next, while the cool-down accelerates recovery, which is critical given the irregular schedule of service.

The AMRAP and AFAP 21-15-9 comprehensive control exercises [1, 5] were used to assess the level of physical fitness; these make it possible to assess the speed-strength endurance of the muscles of the arms and legs and comprehensive endurance, together with the widely known tests of strength endurance (press-ups in the prone position, maximum number of repetitions), speed (the 100 m run) and flexibility (forward bend, cm). Two groups of special unit personnel took part in the experiment, divided into a control group (CG) and an experimental group (EG).

Results of the study and discussion. At the beginning of the experiment no statistically significant differences between the groups were recorded (Table).

After the completion of the experiment, statistically significant differences were revealed in all the tests, with more significant indicators in the EG. Thus, the gain in the indicators in the EG amounted to: control exercises – AMRAP 34.7 %, AFAP 21-15-9 11.01 %; tests – strength endurance 31.3 %, speed 3.86 %, flexibility 31.1 %. In the CG the gain was substantially lower (see the Figure).

The high gain in the flexibility test is explained by the regular application of stretching exercises in the warm-up and concluding parts of the sessions, which in the traditional practice of law enforcement and security agencies is rarely used owing to the underestimation of the significance of flexibility as a professionally important quality.

Table. Indicators of the physical fitness of the personnel of a special unit before and after the educational experiment

Test (unit of measurement)	CG before, M±m	EG before, M±m	t-emp.	p	CG after, M±m	EG after, M±m	t-emp.	p
AMRAP (number of rounds)	13±0.65	14±0.67	1.08	>0.05	16±1.02	19±0.65	2.6	<0.05
AFAP 21-15-9 (s)	357.14±3.25	362.1±3.25	1.04	>0.05	341.43±6.52	322.14±3.95	2.41	<0.05
Test of strength endurance (repetitions)	61±2.57	63±1.57	0.58	>0.05	77±1.71	83±1.47	2.68	<0.05
Test of speed (s)	14.16±0.1	14.26±0.10	0.7	>0.05	14.121±0.15	13.707±0.1	2.6	<0.05
Test of flexibility (cm)	+6.29±1.02	+7.43±0.65	1.06	>0.05	+5.64±0.65	+5.43±0.63	2.56	<0.05

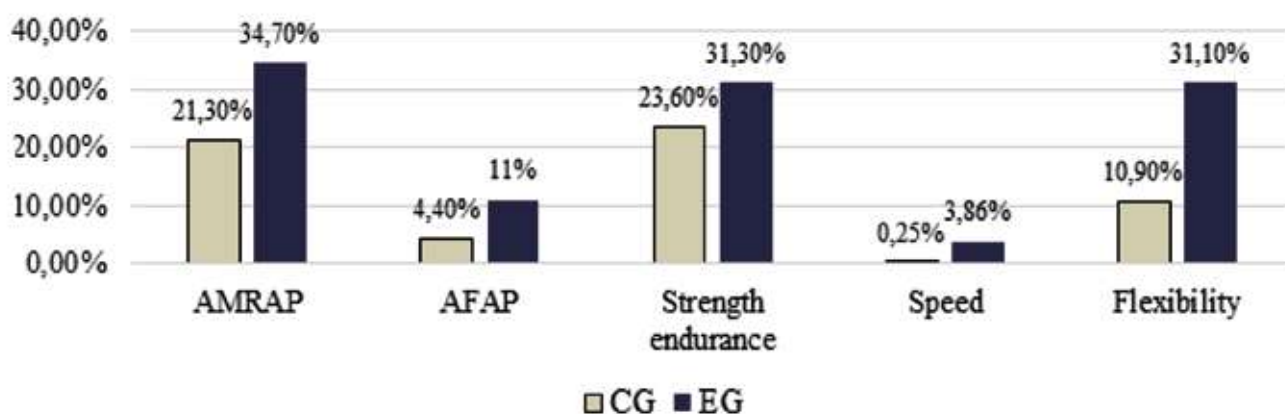


Figure. Gain in the indicators of the EG and CG participants in the experiment, %, after the completion of the trial of the experimental model

Conclusions. The use of CrossFit in the system of the physical training of special unit personnel ensures a high gain in professionally significant physical abilities in comparison with the traditional programme. The model proposed may be extrapolated to other law enforcement and security agencies.

References

1. Andreev Yu.Yu., Gasankhanov Sh.Z., Matorin D.O. Organizatsiya i metodika provedeniya zanyatiy po spetsialnoy funktsionalnoy podgotovke s voennosluzhashchimi i sotrudnikami voysk natsionalnoy gvardii Rossiyskoy Federatsii. Izvestiya Saratovskogo voennogo instituta voysk natsionalnoy gvardii. 2023. No. 2(11). Pp. 7-14.
2. Grechushkin R.S., Zavyalova O.B., Raykov V.K. Sovershenstvovaniye metodiki professionalno-prikladnoy fizicheskoy podgotovki sotrudnikov Rosgvardii sredstvami krossfita. Fizicheskaya kultura, sport – nauka i praktika. 2020. No. 3. Pp. 44-49.
3. Smirnova Yu.V., Saykina E.G., Zyukin A.V., Ishunkin V.S. Effektivnost kompleksnogo primeneniya sredstv krossfita i boksa v protsesse fizicheskoy podgotovki sotrudnikov spetspodrazdeleniy. Teoriya i praktika fizicheskoy kultury. 2021. No. 9. Pp. 35-37.
4. Smirnova Yu.V., Saykina E.G., Ishunkin V.S. Vozmozhnosti primeneniya elementov krossfita i boksa kak sredstv vozdeystviya na psikhicheskiye protsessy i psikhoemotsionalnoye sostoyaniye kombatanov. XXIX Tsarskoselskiye chteniya: Mater. mezhdunar. nauch. konf. V 2-kh tomakh, Sankt-Peterburg, 22-23 aprelya 2025 goda. Sankt-Peterburg: Izd-vo LGU im. A.S. Pushkina, 2025. Pp. 255-260.
5. Glassman G. Foundations. CrossFit Journal. 2002. April. URL: <https://journal.crossfit.com/article/foundations> (date of access: 03.04.2026).



Developing applied life safety skills in students during physical education at the university

UDC 378:796:614.8.



Dr. Hab., Professor **V.V. Ponomarev**¹
PhD, Associate Professor **E.M. Kadomtseva**¹
T.V. Fateeva¹
V.V. Grigoriev¹
¹Krasnoyarsk State Medical University, Krasnoyarsk

Corresponding author: avavifk@yandex.ru

Received by the editorial office on 10.05.2026

Abstract

Objective of the study is to substantiate and develop an integrated approach to the formation of applied life safety skills in students on the basis of the current physical education programme at the university.

Methods and structure of the study. The study was conducted at the educational and practical facilities of the Krasnoyarsk State Medical University named after Prof. V.F. Voino-Yasenetsky of the Ministry of Health of Russia, Krasnoyarsk (KrasSMU). The research methods were: analysis of the scientific and methodological literature, questionnaires, discussions, surveys, pedagogical observation, modelling, systematisation, methods of mathematical statistics, and others. The review-based theoretical study carried out contributed to the collection of the necessary material, which made it possible to develop an experimental organisational and methodological condition for an integrated approach to the formation of applied life safety skills in students on the basis of the current physical education programme at the university.

Results and conclusions. The analytical study carried out contributed to the development and design of the organisational and pedagogical conditions of an integrated approach within the current programme of the physical education of students at the university, which on the whole makes it possible to form the readiness of student youth for safe living in the university environment. The sections of the educational and practical programme are oriented towards the comprehensive formation in students of applied theoretical knowledge and practical skills of safe living: «Skiing» – readiness to move safely in a snowy environment; «Swimming» – readiness for safe living in an aquatic environment; «Tourism» – readiness for safe living in various conditions of the natural environment; «Athletics» – readiness to move across broken terrain in various landscape conditions, to overcome obstacles and so on; «Sports games» – readiness of students for team interaction and mutual assistance, and the ability to assess non-standard game situations correctly and to respond promptly with an adequate and appropriate motor action; «Combat sports» – readiness of students to defend themselves and those close to them against various types and forms of aggression and attack; «All-Russian Physical Culture and Sports Complex GTO» – readiness of students to meet the GTO standards, which contributes to the formation of applied and general physical fitness; «Provision of first aid» – readiness of students to provide timely and necessary first aid in any adverse life situation. Thus, the content and sections of the physical education programme for students at the university are not changed; only its focus is adjusted towards the formation of the safe living of student youth.

Keywords: *applied skills, formation, safe living, students, university, physical education, integrative approach, organisational and pedagogical conditions, programme.*

Introduction. In the modern world, the safety of the life of human society is a matter of particular concern. This situation is connected above all with the increase in various man-made and ecological disasters, the decline in socio-economic development in a number of countries, the aggravation of political and military tension between states, and so on. All this has, on the whole, given rise to an important need to form in the population a readiness to withstand internal and external threats and to ensure their own safe living. In this connection, particular importance attaches to the country's educational system, in which it

is necessary not only to train future specialists for the socio-economic development of the country, but also to form in student youth a readiness for safe living. At the basis of the formation of a person's safe living lies physical fitness. In this connection, the practical discipline «Physical Culture and Sport» at the university is charged with the important task of forming the physical fitness required for safe living, and it was this that constituted the aim of the present work.

Objective of the study is to substantiate and develop an integrated approach to the formation of applied life safety skills in students on the basis of the cur-



Table. Educational and practical material for the formation of the comprehensive readiness of students for safe living in physical education classes at the university

Educational and practical sections of the programme	Applied focus	Applied life safety skills formed in various environments
«Skiing»	Formation of practical skills of moving on skis	Readiness to move safely in a snowy environment
«Swimming»	Formation of practical swimming skills	Readiness for safe living in an aquatic environment
«Tourism»	Formation of theoretical knowledge and practical skills of tourist activity	Readiness for safe living in the various conditions of hiking trips
«Athletics»	Formation of practical skills of the basic types of human locomotion: jumping, running, walking, throwing, climbing over, jumping over, and so on	Readiness for safe living in various landscape conditions and on broken terrain
«Sports games»	Formation of practical skills and abilities of team interaction, mutual support, organisation, and so on	Readiness for safe motor activity in conditions of hard collisions, and for taking the correct motor decision in a rapidly changing situation
«Combat sports»	Formation of practical self-defence skills	Readiness to defend oneself and those close to one against various types of physical violence and aggression
«All-Russian Physical Culture and Sports Complex GTO»	Formation of practical skills of meeting the GTO standards	Comprehensive applied physical readiness of students for various life situations and dangers
«Provision of first aid»	Formation of theoretical knowledge and practical skills of providing first aid	Readiness to provide the necessary first aid in any situation

rent physical education programme at the university.

Methods and structure of the study. The study was conducted at the educational and practical facilities of the Krasnoyarsk State Medical University named after Prof. V.F. Voyno-Yasenetsky of the Ministry of Health of Russia, Krasnoyarsk (KrasSMU). The research methods were: analysis of the scientific and methodological literature, questionnaires, discussions, surveys, pedagogical observation, modelling, systematisation, methods of mathematical statistics, and others. The review-based theoretical study carried out contributed to the collection of the necessary material, which made it possible to develop an experimental organisational and methodological condition for an integrated approach to the formation of applied life safety skills in students on the basis of the current physical education programme at the university.

Results of the study and discussion. The scientific and theoretical work carried out contributed to the integration of the sections of the educational and practical programme of physical education into the process of the comprehensive preparation of students for safe living (Table).

Conclusions. The comprehensive programme developed on the basis of the current programme of the physical education of students at the university makes it possible to form in student youth, correctly and ef-

fectively, an applied readiness for safe living, which at present is a relevant and necessary condition for the preservation of the human being.

References

1. Ponomarev V.V. Model upravleniya bezopasnoy zhiznedeyatel'nostyu detey i podrostkov v usloviyakh letnego ozdorovitel'nogo otdykha. Materialy nauchno-prakticheskoy konferentsii s mezhdunarodnym uchastiem, posvyashchennoy 90-letiyu so dnya obrazovaniya Akademii GPS MChS Rossii. V 5-ti chastyakh. Moskva. 2023. Pp. 218-223.
2. Ponomarev V.V. Organizatsionnye formy i algoritmy formirovaniya kultury bezopasnoy zhiznedeyatel'nosti u naseleniya. Materialy nauchno-prakticheskoy konferentsii s mezhdunarodnym uchastiem, posvyashchennoy 90-letiyu so dnya obrazovaniya Akademii GPS MChS Rossii. V 5-ti chastyakh. Moskva. 2023. Pp. 223-226.
3. Ponomarev V.V., Boyarinova S.P., Steblyanskiy L.N. Podgotovka naseleniya k deystviyam v chrezvychaynykh situatsiyakh po mestu zhitelstva. Materialy IV Vserossiyskoy nauchno-prakticheskoy konferentsii «Aktualnye problemy obespecheniya pozhar'noy bezopasnosti i zashchity ot chrezvychaynykh situatsiy». Krasnoyarskiy kray, g. Zheleznogorsk. 2023. Pp. 376-378.



The relationship between subjective well-being and involvement in physical activity and sport among the residents of the Nizhny Novgorod Region

UDC 159.9.07



PhD **D.V. Zharova**¹

PhD, Associate Professor **L.V. Skitnevskaya**¹

PhD, Associate Professor **E.M. Kochneva**¹

PhD, Associate Professor **N.N. Kuimova**¹

¹Minin Nizhny Novgorod State Pedagogical University, Nizhniy Novgorod

Corresponding author: zharodar@yandex.ru

Received by the editorial office on 11.06.2026

Abstract

Objective of the study is to assess the relationship between subjective well-being and the involvement of the population of the Nizhny Novgorod Region in physical activity and sport.

Methods and structure of the study. The study sample consisted of 37,539 residents of the municipal and urban districts of the Nizhny Novgorod Region. The sample is characterised as a socially active, predominantly female audience of middle age with a stable family status and a pronounced involvement in employment and physical activity.

Results and conclusions. The authors of the article draw attention to the significance of the results obtained and to an understanding of the importance of physical activity and sport in the formation of the subjective well-being of the population of the Nizhny Novgorod Region. Regular physical activity raises the level of subjective well-being of the residents of the region: physically active citizens demonstrate a statistically significantly higher level of life satisfaction. The data obtained may be used to develop an index of the satisfaction of the population of the Nizhny Novgorod Region with the existing sports infrastructure. On the basis of the variables concerning sources of information, it is possible to investigate the effectiveness of the various channels of informing people about sporting opportunities and events, and to identify the most effective sources of information for different age and social groups.

Keywords: *well-being, physical activity, sport, population, Nizhny Novgorod Region.*

Introduction. The relevance of the topic is determined by the need to study the fundamental psychological problem of the subjecthood of the personality [9], as well as the factors influencing subjective well-being, emotional well-being, psychological health and the quality of life of the individual and of society as a whole [10]. O.A. Kovaleva notes that the contemporary socio-political situation in Russia brings to the fore the problem of preserving psychological health and well-being, which act as some of the central constructs of contemporary positive psychology and as indicators of the effectiveness of human adaptation [6].

In the work of J. Butler, physical health correlates with psychological well-being [12]; Russian studies show the presence of a stable relationship between the level of subjective well-being and involvement in physical activity and sport: the activity of the way of life and subjective well-being (V.N. Oslon et al.) [7], the relationship between quality of life and physical activi-

ty (A.E. Khusainov and co-authors) [11], and the presence of a positive correlation between indicators of physical activity and subjective life satisfaction (V.M. Gritchina, N.A. Khorkina) [2].

Objective of the study is to assess the relationship between subjective well-being and the involvement of the population of the Nizhny Novgorod Region in physical activity and sport.

Methods and structure of the study. The study sample consisted of 37,539 residents of the municipal and urban districts of the Nizhny Novgorod Region: 83.8 % of the sample were middle-aged women (36–60 years) engaged in employment. More than half of the respondents (53.7 %) regularly take part in physical activity, and 2.2 % are professional athletes. The respondents predominantly choose accessible and universal forms of physical activity that do not require special equipment, for example running, walking, fitness and gymnastics, which testifies to the existence



among the population of a stable interest in independent physical activity with the aim of maintaining physical fitness and health, and also indicates the potential and prospects for the further development of amateur and mass forms of physical culture. On the whole, the sample may be characterised as a predominantly female audience of middle age involved in employment and physical activity.

The Russian-language version of the questionnaire 'The PERMA Profiler' (Julie Butler, Margaret L. Kern) in the adaptation of O.M. Isaeva, A.Yu. Akimova and E.N. Volkova [4] was used to assess subjective well-being.

Results of the study and discussion. An analysis of the average indicators of subjective well-being by municipality shows that the values are on the whole at a stably high level and vary within the range from 6.67 to 7.95 points on a ten-point scale; this testifies to a high subjective sense of well-being in the population studied. The data obtained show that there is insignificant inter-municipal variation in the level of subjective well-being: the difference between the minimum and maximum indicators across the municipal districts of the Nizhny Novgorod Region amounts to 1.3 points. Proceeding from this, it may be concluded that the level of the subjective psychological well-being of the respondents is distributed fairly evenly across the territory of the region, with the presence of individual zones of slight lag and points of growth.

Correlation, statistical and moderation analysis showed the following results: residents of the Nizhny Novgorod Region who engage in physical activity or sport have a higher level of subjective well-being in comparison with those who do not; satisfaction with the sports infrastructure raises the level of the subjective well-being of the respondents; and a more attractive district for physical activity and sport is associated with an increase in subjective well-being, which underlines the importance of implementing a comprehensive approach to improving the urban environment and the sports infrastructure in order to raise the quality of life and the level of subjective well-being of the residents of the Nizhny Novgorod Region.

Respondents whose physical activity is regular in character have a higher level of subjective well-being, are to a greater degree involved in physical activity and sport, and are also more inclined to assess their district of residence as attractive and the sports infrastructure available in it as being of high quality, safe and accessible.

Using the available socio-demographic, infrastructural and behavioural variables – for example, data on the sports participation of children and parents – it is possible to investigate the influence of family models of behaviour on children's involvement in sport, the role of parents in the choice of activities, and the mechanism of the formation of stable habits of physical activity. The data on satisfaction with, and perception of, the infrastructure make it possible to construct an index of satisfaction with the infrastructure, as well as to identify the municipalities with the greatest gap between the actual availability of sports and fitness centres and their subjective perception. On the basis of the variables concerning sources of information, it is possible to investigate the effectiveness of the various channels of informing people about sporting opportunities and events, and to identify the most effective sources of information for different age and social groups.

E.V. Gryaznova notes that the modern world creates a particular social subject – the 'digital person', whose socialisation takes place under the conditions of digital culture [3], which it is important to take into account when developing further prospective research on the connection between the subjective well-being of the personality and involvement in physical activity and sport. The use of digital tools – for example, online workouts, fitness trackers and mobile applications that 'read' the level of physical activity of the 'digital person' – will make it possible to integrate physical activity and sport effectively into everyday life, to reduce the negative influence of digitalisation and to raise the level of the subjective well-being of the personality.

The value of the study also consists, first, in the possibility of using the results of the questionnaire survey and diagnostics for the realisation of the tasks of the personal development of young people by the means of physical education and sport, which, according to the position of I.Yu. Burkhanova, are recognised as an effective instrument not only of physical improvement but also of the formation of key personal qualities (will, communication, responsibility, stress resistance) [1];

– second, for an understanding of the role of parents who engage in sport and display physical activity in fostering independence and developing the volitional qualities of children, and in the formation of positive parent-child relations as a factor conditioning the subjective well-being of the personality [8];

– third, young people engaged in physical culture



demonstrate a higher level of activity in everyday life, a capacity to manage their emotional state and actions, and emotional restraint and resilience, which may contribute to the development of confidence and stress resistance, as well as to an improvement in well-being [5] and subjective psychological well-being.

Conclusions. Thus, the database already available opens up wide possibilities for in-depth analysis and for the construction of models explaining the key factors of the physical activity and satisfaction of the population of the Nizhny Novgorod Region. The data obtained may serve as a basis for further prospective research, for example research aimed at identifying the factors exerting an influence on the subjective well-being, motivation and involvement of the residents of Nizhny Novgorod and the Nizhny Novgorod Region in physical activity and sport.

References

1. Burkhanova I.Yu., Stafeeva A.V., Ivanova S.S., Musin O.A. Metodologicheskiye osnovy sozdaniya modeli lichnostnogo razvitiya molodezhi sredstvami fizicheskogo vospitaniya i sporta v usloviyakh dopolnitelnogo fizkulturnogo obrazovaniya. *Teoriya i praktika fizicheskoy kultury*. 2025. No. 10. Pp. 64-66.
2. Gritchina V.M., Khorkina N.A. Delayut li zanyatiya sportom molodykh rossiyan schastliveye? *Voprosy statistiki*. 2022. V. 29. No. 3. Pp. 112-124.
3. Gryaznova E.V. Antropologiya tsifrovogo cheloveka: k voprosu o metodologii issledovaniya. *Vestnik antropologii*. 2025. No. 2. Pp. 173-186.
4. Isaeva O.M., Akimova A.Yu., Volkova E.N. Oprosnik blagopoluchiya PERMA-Profil: aprobatsiya russkoyazychnoy versii. *Sotsialnaya psikhologiya i obshchestvo*. 2022. V. 13. No. 3. Pp. 116-133.
5. Morozova E.A., Kuimova N.N. Spetsifika proyavleniya psikhologicheskogo blagopoluchiya sovremennoy studencheskoy molodezhi, zani-mayushcheysya fizicheskoy aktivnostyu. *Nizhegorodskiy psikhologicheskiy almanakh*. 2024. No. 1. Pp. 42-51.
6. Kovaleva O.A., Sorokoumova S.N. Psikhodiagnosticheskiye vozmozhnosti izmereniya psikhologicheskogo blagopoluchiya. *Vestnik Mininskogo universiteta*. 2026. V. 14. No. 1. Pp. 14. DOI: 10.26795/2307-1281-2026-14-1-14.
7. Oslon V.N., Prokopeva L.M., Kolesnikova U.V. Aktivnost obraza zhizni, subyektivnoye zdorovye i subyektivnoye blagopoluchiye detey starshego podrostkovogo i yunosheskogo vozrasta v Rossiyskoy Federatsii. *Psikhologicheskaya nauka i obrazovaniye*. V. 27. No. 6. Pp. 116-129.
8. Serebryakova T.A., Kolesnikova I.G., Ivanova I.A., Razorenova V.A. Obshcheniye s roditeleyami kak usloviye psikhologicheskoy bezopasnosti podrostka. *Perspektivy nauki i obrazovaniya*. 2026. No. 2(80). Pp. 515-533.
9. Serebryakova T.A., Gaponova S.A., Minaeva E.V. Professionalnoye samoopredeleniye kak usloviye razvitiya subyektivnosti lichnosti. *Vestnik prakticheskoy psikhologii obrazovaniya*. 2025. V. 22. No. 2-1. Pp. 195-207.
10. Stepanova Yu.S. Kontseptualnye osnovaniya emotsionalnogo blagopoluchiya: opredeleniye i struktura. *Vestnik Mininskogo universiteta*. 2026. V. 14. No. 1. P. 11. DOI: 10.26795/2307-1281-2026-14-1-11.
11. Khusainov A.E., Zulkarnaev T.R., Povargo E.A., Mochalkin P.A., Agafonov A.I., Zalalova A.A. Vzaimosvyaz kachestva zhizni i fizicheskoy aktivnosti studencheskoy molodezhi. *Medsina truda i ekologiya cheloveka*. 2022. No. 2. Pp. 67-74.
12. Butler J., Kern M.L. The PERMA-Profil: A brief multidimensional measure of flourishing. *International Journal of Wellbeing*. 2016. V. 6(3). Pp. 1-48.



Improving the physical literacy of pupils aged 10–11 on the basis of the Chinese Healthy Physical Education Curriculum Model

UDC 796.011.3



Dr. Phys.-Math., Associate Professor **Zhu Qiuhan**¹

Yang Yuzhou¹

Ma Kehan²

Dr. Hab., Professor **V.S. Makeeva**²

¹Zhengzhou University, Zhengzhou

²The Russian University of Sport «GTSOLIFK», Moscow

Corresponding author: zhuqiuhan@zzu.edu.cn

Received by the editorial office on 20.07.2026 r.

Abstract

Objective of the study is to identify the effectiveness of the use of the means of wushu in the physical education of pupils aged 10–11.

Methods and structure of the study. The objects of the study were 90 pupils aged 10–11 from a primary school in the city of Zhengzhou, randomly divided into experimental group A, experimental group B and a control group. A programme for teaching wushu on the basis of the Chinese Healthy Physical Education Curriculum Model was developed. An educational experiment lasting 14 weeks was conducted using instruments for assessing physical literacy and a scale of children's physical activity. An inter-group comparison was made of the indicators of the physical literacy of the pupils of the three groups after the experiment, and the average magnitude of the improvement of these indicators across all the dimensions was calculated.

Results and conclusions. In the dimensions of motivation and confidence, knowledge and understanding, daily behaviour and physical abilities, the gain in the indicators in experimental group A was significantly higher than in experimental group B and in the control group. For the majority of the indicators, no statistically significant differences were revealed between experimental group B and the control group. For the indicator of 'physical activity over the last seven days' no significant differences between the three groups were found; however, the maximum magnitude of the gain in results was observed in group A. On the whole, this testifies that the teaching of wushu on the basis of the Chinese Healthy Physical Education Curriculum Model makes it possible to raise the level of the physical literacy of pupils aged 10–11 more reliably and comprehensively, and that its effectiveness is clearly higher than that of the traditional teaching of wushu and of standard physical education lessons.

Keywords: *Chinese Healthy Physical Education Curriculum Model, teaching of wushu, physical literacy.*

Introduction. Wushu belongs to the traditional Chinese forms of physical culture. Its main content consists of martial motor actions, and its principal forms are technical routines and training bouts. This sport is oriented towards the harmonious improvement of the spiritual and physical state, the motor skills, the moral qualities and the personal characteristics of pupils.

It is assumed that a study of the effect of teaching wushu according to the Chinese Healthy Physical Education Curriculum Model will contribute to raising the level of pupils' physical and mental

health, thereby supporting the reform of physical education in China.

Objective of the study is to identify the effectiveness of the use of the means of wushu in the physical education of pupils aged 10–11.

Methods and structure of the study. Ninety pupils aged 10–11 from a primary school in the city of Zhengzhou, randomly divided into experimental group A, experimental group B and a control group, took part in an educational experiment lasting 14 weeks. For group A a programme for teaching wushu on the basis of the Chinese Healthy Physical



Table 1. Programme for teaching wushu on the basis of the Chinese Healthy Physical Education Curriculum Model (experimental group A)

Part of the lesson	Content of the session	Time
Preparatory part	Running, dynamic stretching and other exercises, playful activities under the guidance of the teacher	8 minutes
Main part	Practice of the basic technical elements of wushu; learning of Elementary Long Fist Routine No. 3; group competitions in the basic elements and in Elementary Long Fist Routine No. 3	25 minutes
Physical preparation exercises	Development of strength qualities, endurance, agility, coordination and speed; core training	10 minutes
Concluding part	Relaxing stretching by the pupils, summing up the lesson, homework assignment	2 minutes

Education Curriculum Model was developed. Group B was taught by the traditional method of teaching wushu. The control group followed the course 'Physical Education and Health'.

For experimental group A, the content of the training programme developed, with the inclusion of the basic technical elements of wushu of Elementary Long Fist Routine No. 3 and of physical preparation exercises on the basis of the Chinese Healthy Physical Education Curriculum Model, is presented in Table 1.

Experimental group B was taught by the traditional method of teaching wushu with the same learning content: the basic technical elements of wushu and Elementary Long Fist Routine No. 3 (Tables 2 and 3).

The control group followed the plan of the course 'Physical Education and Health' in accordance with the requirements presented in the teachers' methodological manual for the course 'Physical Education and Health' for the 5th class of the general education school.

The Canadian Assessment of Physical Literacy, second edition (CAPL-2), and the Physical Activity Questionnaire for Older Children (PAQ-C) were used to assess the level of physical literacy. The following indicators were assessed: motivation and confidence, knowledge and understanding, daily motor activity and physical abilities.

Results of the study and discussion. The results of the experiment showed that for the indicator 'Motivation and confidence' group A achieved

Table 2. Traditional programme for teaching wushu (experimental group B)

Main learning content	Organisation of the sessions	Time
Practice of the basic technical elements of wushu; learning of Elementary Long Fist Routine No. 3	The teacher explains and demonstrates the exercises; the pupils observe, learn and perform collective training. Independent training by the pupils, with the teacher observing and advising. Assembly of the pupils, joint correction of errors and advice. Collective training and demonstration of the results. Free activity of the pupils	30 minutes

Table 3. Inter-group differences in the indicator 'Knowledge and understanding' in the learners before the experiment

Indicator	Group	$\bar{X} \pm S$	Comparison with the control group
Motivation and confidence	Experimental A	24.07 ± 1.96	$t=2.468, p=0.017 \uparrow$
	Experimental B	22.83 ± 1.75	$t=0.383, p=0.703$
	Control	22.62 ± 2.56	— (reference group)

Table 4. Inter-group differences in the indicator 'Knowledge and understanding' in the learners after the experiment

Indicator	Group	$\bar{X} \pm S$	Comparison with the control group
Knowledge and understanding	Experimental A	7.63 ± 1.25	$t=0.667, p=0.508$
	Experimental B	7.00 ± 1.08	$t=-1.557, p=0.125$
	Control	7.43 ± 1.07	— (reference group)



Table 5. Inter-group test of the differences in the indicators of moderate and vigorous physical activity over seven days in the pupils of the three groups after the experiment

Indicator	Group	$\bar{X} \pm S$	Comparison with the control group
Moderate and vigorous physical activity over seven days	Experimental A	3.73 ± 0.74	$t=3.046, p=0.003 \uparrow$
	Experimental B	3.17 ± 0.70	$t=-0.197, p=0.845$
	Control	3.20 ± 0.61	— (reference group)

Table 6. Inter-group test of the differences in the indicators of physical activity over the last seven days after the experiment

Indicator	Group	$\bar{X} \pm S$	Comparison with the control group
Physical activity over the last seven days	Experimental A	16.25 ± 1.45	$t=-0.078, p=0.938$
	Experimental B	15.87 ± 1.43	$t=-0.985, p=0.329$
	Control	16.28 ± 1.83	— (reference group)

results for which significant differences from experimental group B and from the control group were revealed. Between experimental group B and the control group no statistically significant differences were established.

For the measurement of the indicator ‘Knowledge and understanding’, significant differences were revealed between experimental group A and experimental group B. Between experimental group A and the control group, and also between experimental group B and the control group, no statistically significant differences were established (Table 4).

In terms of the effectiveness of raising the indicators of the dimension ‘Knowledge and understanding’, the best result was demonstrated by experimental group A, second place was taken by the control group, and the smallest gain was shown by experimental group B.

The indicator ‘Daily behaviour’ includes two measures: ‘Moderate and vigorous physical activity over seven days’ and ‘Physical activity over the last seven days’ (Tables 5, 6 and 7).

In the test of moderate and vigorous physical activity over seven days, significant differences were revealed between experimental group A on the one hand and experimental group B and the control group on the other; between experimental group B and the control group no statistically significant differences were established. In terms of the effectiveness of raising the indicators, the best result was demonstrated by experimental group A, second place was taken by the control group, and the smallest gain was shown by experimental group B.

In the test of physical activity over the last seven days, no statistically significant differences between the three groups were revealed; however, in terms of the effectiveness of raising the indicators the best result was likewise observed in experimental group A, second place in the control group, and the smallest gain in experimental group B.

The testing of physical abilities showed that between experimental group B and the control group there are no statistically significant differences. In terms of the effectiveness of raising all three indicators, the best result was demonstrated by ex-

Table 7. Results of the comparison of the experimental groups with the control group after the experiment

Indicator	Comparison	ΔX	t	p	Interpretation of the result
CAMSA	EG A and CG	+0.51	2.522	0.014	Experimental group A significantly surpasses the control group
	EG B and CG	+0.05	0.246	0.806	The differences are not significant
20 m shuttle run (time, s)	EG A and CG	+1.40	4.860	0.000	Experimental group A shows a significantly worse time
	EG B and CG	+0.53	1.901	0.062	A tendency towards a worsening of the time is observed ($p = 0.062$)
Plank (time, s)	EG A and CG	+0.70	2.314	0.024	Experimental group A holds the plank significantly better
	EG B and CG	-0.30	-1.031	0.307	The differences are not significant; group B is slightly worse



perimental group A, second place was taken by the control group, and the smallest gain was shown by experimental group B.

Thus, the results obtained from the testing of the physical fitness of the Chinese pupils testify that the teaching of wushu on the basis of the Chinese Healthy Physical Education Curriculum Model exerts a more pronounced influence on the formation of the physical literacy of pupils aged 10-11.

Conclusions. The present study enriches practical developments in the field of educational models and of the physical literacy of children and adolescents in China, to a certain degree contributes to the reform of physical education, and stimulates an increase in the level of physical literacy of children and adolescents in the country.

References

1. Ji Liu. Reflections and Construction of the Chinese Healthy Physical Education Curriculum Model. Journal of Beijing Sport University. 2015. V. 38. No. 09. Pp. 72-80.
2. Ji Liu. A Further Study on the Theoretical and Practical Issues of the Chinese Healthy Physical Education Curriculum Model. Journal of Beijing Sport University. 2019. V. 42. No. 06. Pp. 12-22.
3. Ren Hai. Physical Literacy: A Concept Guiding the Reform and Development of Contemporary Sports. China Sport Science. 2018. V. 38. No. 3. Pp. 3-11.
4. Su Jianzhen, Ji Liu. An Analysis of the Concept of 'Exercise Density' Based on the Chinese Healthy Physical Education Curriculum Model. Journal of Capital University of Physical Education and Sports. 2019. V. 31. No. 05. Pp. 406-416.
5. Yang Jianying, Guo Fumo. An Analysis of the Problems Existing in the New Definition of Wushu and the Ways to Revise It. Journal of Physical Education. 2014. V. 21. No. 01. Pp. 23-28.



Social and organisational factors of students' mastery of swimming skills

UDC 797.2



PhD **T.I. Melnikova**¹

PhD, Associate Professor **L.V. Morozova**¹

O.P. Vinogradova¹

¹The Russian Presidential Academy of National Economy and Public Administration, Saint Petersburg

Corresponding author: melnikova-ti@ranepa.ru

Received by the editorial office on 11.05.2026

Abstract

Objective of the study is to identify the socio-demographic and organisational factors of students' mastery of swimming competences that reduce the risk of accidents.

Methods and structure of the study. A survey was conducted of 125 students of a management university from all years of study: 57 (47.7 %) women and 68 (52.3 %) men. The study was carried out by the method of cross-sectional design using a questionnaire that included questions relating to socio-demographic data, organisational factors and the level of swimming competences.

Results and conclusions. Students who mastered swimming skills before entering university possess better competences relating to safety on the water. Students in the senior years have a better command of the skills of sports and applied swimming. The priority in the sphere of safety on water bodies is the formation of the ability to perform applied techniques and actions.

Keywords: *swimming preparedness of students, applied skills, incidents on the water, social and organisational factors.*

Introduction. Numerous studies show that unsupervised presence at unequipped water bodies represents a real threat to the life and health of young people. Serious incidents on the water also occur in swimming pools. The factors of safety must be studied in depth in order to prevent accidents on the water [3].

An analysis of the contemporary literature leads to the conclusion that the existing methods of assessing the level of students' swimming preparedness are somewhat limited [6]. The assessment does not take into account a number of applied skills, for example the ability to cover long distances by swimming and the basic skills of survival in the water [4]. As a rule, the level of swimming preparedness is assessed on the basis of the command of the technique of the sports strokes [1]. The studies performed have shown that the level of mastery of swimming skills may be influenced by gender,

length of training, age, region and the accessibility of swimming pools [2]. In addition, the ability to keep oneself on the water by means of sculling movements reduces the number of accidents in water areas [7].

Nevertheless, a representative database is required for the further study of this serious problem. The need to assess the factors of the formation of swimming skills is conditioned by the correlation of the ability to swim with safety on the water and with a reduction in the number of accidents and drownings [5].

Objective of the study is to identify the socio-demographic and organisational factors of students' mastery of swimming competences that reduce the risk of accidents on the water.

Methods and structure of the study. A survey was conducted of 125 students of a management university from all years of study: 57 (47.7 %) wom-



en and 68 (52.3 %) men. The age of the students who took part in the study was 19.7 ± 1.1 years.

The study was carried out by the method of cross-sectional design using a questionnaire that included questions relating to socio-demographic data, organisational factors and the level of swimming competences.

The socio-demographic data included age, gender, year of study and the educational level of the parents.

The organisational factors were characterised by the age at which swimming lessons began, the total length of training, the duration of an individual session (in minutes), and the number of sessions in the pool during a month.

The swimming competences reflected the abilities to swim the maximum distance by any stroke; to swim with a kickboard using the legs only; to hold the breath under water; to float on the water; to keep oneself on the surface of the water by means of sculling movements; and to dive for distance. The maximum swimming distance was taken to be the distance which the participants could swim independently without rest.

In studying injury-prone situations while in the water, the participants answered questions relating to accidents or injuries sustained while at open water bodies. The answers were coded as follows: 1 – the participant had been involved in an incident on the water; 0 – there had been no adverse incidents on the water in the participant's experience.

In order to assess the relationship between the level of command of swimming skills and the possibility of reducing injury-prone situations in the water, regression analysis was used with the construction of a logistic and a hierarchical multiple model.

The beta-distribution coefficient (β) was used to model the probability of the occurrence of accidents under the influence of a particular factor. The confidence interval (CI) reflected the true value of the regression coefficient with a probability of 95 %. Two-way analysis of variance based on the calculation of Fisher's F-test was used to assess the differences between the groups. The quality of the model was assessed on the basis of the coefficient of determination R^2 . The analysis was carried out using SPSS software, version 24.0.

Results of the study and discussion. The results of the study indicate that men can swim on average 102.3 m and women 76.5 m. It was found that the swimming distance increases with each year of study. More than 80 % of the participants were able to perform the initial exercises for familiarisation with the water (swimming with a kickboard, keeping oneself on the water, diving). About 35 % of the students reported that they were unable to swim more than 5 metres using sculling movements. An even greater number of students were unable to perform the applied swimming techniques.

The results of the study make it possible to assess the current state of the swimming skills of higher-education students. Given that the specialist literature studies factors predominantly reflecting the causes of serious incidents on the water, the data of the study conducted establish a significant connection between the command of swimming skills and safety at natural water bodies, which helps to broaden the understanding of this question and to contribute to the theory and methods of the mass teaching of applied swimming skills to higher-education students. The results of the study conducted indicate that more than 65 % of those

Table. Parameters of the hierarchical linear models of multiple regression

Factors	β	CI	F	R^2
Age at which swimming instruction began	0.139	0.07:0.34	10.34	0.73
Gender	0.043	0.03:0.47	7.66	0.62
Educational level of the parents	0.327	0.14:0.46	9.53	0.57
Length of swimming training	0.138	0.03:0.32	17.48	0.66
Frequency of sessions per week	0.126	0.03:0.32	14.32	0.83
Duration of a session	0.255	0.17:0.47	22.84	0.71
Sessions in a swimming pool	0.335	0.15:0.49	18.52	0.69
Sessions in an open water body	0.246	0.11:0.45	9.65	0.70
Skills of the sports strokes	0.543	0.15:0.62	18.97	0.52
Command of applied techniques in the water	0.428	0.26:0.57	24.24	0.84



surveyed are able to perform the tasks proposed, and that 31.5 % of them cannot swim a distance of more than 10 m.

The study performed showed that men possess a higher level of swimming preparedness than women.

Factors influencing the mastery of swimming skills are the location of the pool and the accessibility of swimming facilities (public, school and sports-club facilities), which correlate positively with the level of swimming preparedness.

Despite the fact that the duration of an individual session, the frequency of sessions per week and the length of instruction in swimming skills were significant factors influencing the level of students' swimming preparedness, they cannot fully ensure the neutralisation of the risks associated with the unpredictability of the physical conditions of the aquatic environment (temperature, currents, water transparency, the depth and relief of the bottom of the water body, and the presence of underwater objects).

A significant factor influencing the effectiveness of instruction in swimming skills was the age at which the lessons began. Beginning swimming instruction in the senior classes is less effective than in primary school.

No differences in the risks of the occurrence of injury-prone incidents while in the water were established between men and women.

Each of the factors comprising the duration of initial instruction, the accessibility of sessions, the length of swimming training and the level of command of swimming skills was a significant precondition reducing the risk of the occurrence of accidents on the water. The majority of the students visited bathing places at open water bodies or swimming pools under the supervision of duty instructors and physical education teachers, which may have influenced the low level of risk of the occurrence of potentially dangerous incidents.

Conclusions. Students who mastered swimming skills before entering university possess better experience, knowledge and competences relating to safety on the water. Students in the senior years have a better command of the skills of sports and applied swimming.

The priority in the sphere of safety at water facilities and open water bodies is not only the formation of the skills of the sports strokes, but also of abilities connected with the performance of techniques and actions of an applied character.

References

1. Bolotin A.E., Van Zwieten K.Ya., Ponimasov O.E., Timchenko N.M., Aganov S.S. Otsenka urovnya trenirovannosti sportsmenok v plavanii na osnove analiza pokazateley variabelnosti serdech-nogo ritma. *Teoriya i praktika fizicheskoy kultury*. 2020. No. 7. Pp. 10-12.
2. Bolotin A.E., Bakayev V., Ponimasov O.E., Vasilieva V. Peculiarities of respiratory functions in qualified swimmers exposed to multidirectional physical loads. *Journal of Human Sport and Exercise*. 2022. V. 17. No. 4. Pp. 860-866.
3. Gerasimov M.V., Mironov A.O., Ponimasov O.E., Fetisov V.N. Snizheniye dvigatelnykh disfunktsiy, vyzvannykh vodoboyaznyu, pri obuchenii plavaniyu studentov upravlencheskogo vuza. *Teoriya i praktika fizicheskoy kultury*. 2025. No. 9. Pp. 80-82. EDN: SXRACB.
4. Zyukin A.V., Ponimasov O.E., Bolotin A.E., Shelkova L.N. Kontrol perifericheskoy gemodinamiki plovtsov kategorii «Masters». *Teoriya i praktika fizicheskoy kultury*. 2020. No. 12. Pp. 67-69. EDN: GWUGDH.
5. Maryin I.S., Gridneva E.V., Fetisov V.N., Ponimasov O.E. Faktory effektivnosti tekhniki plavaniya na uchebno-trenirovochnom etape podgotovki yunyx plovtsov-sprinterov. *Teoriya i praktika fizicheskoy kultury*. 2026. No. 3. Pp. 93-95.
6. Ponimasov O.E. Polifunktsionalnost gidrogen-nykh lokomotsiy kak dvigatelnykh substratov prikladnogo plavaniya. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 4. Pp. 3-5.
7. Shtamburg I.N., Ponimasov O.E., Grachev K.A., Novikov A.I. Ekonomizatsiya tipologicheskikh kombinatsiy tekhniki prikladnogo plavaniya pri obuchenii kursantov voyennykh vuzov. *Teoriya i praktika fizicheskoy kultury*. 2016. No. 2. Pp. 16-17. EDN: VOLNTV.



Functional approach to the organisation of classes in a special educational department

UDC 796.378



Dr. Hab., Associate Professor **A.O. Egorychev**¹

PhD, Associate Professor **E.V. Egorycheva**²

D.I. Priimenko²

A.V. Priimenko³

¹National University of Oil and Gas «Gubkin University», Moscow

²Moscow Polytechnic University, Moscow

³Donetsk State University, Donetsk

Corresponding author: egorychev64@yandex.ru

Received by the editorial office on 01.06.2026

Abstract

Objective of the study is to identify the possibilities of distributing the students of a special medical group into functional classes using the assessment of the physical condition index (PCI) according to E.A. Pirogova.

Methods and structure of the study. The research was conducted in the autumn period of the 2025-2026 academic year. The object of the study was the students of a special educational department who, according to the results of medical monitoring, had been assigned to a special medical group. Two methods were used in the work: the assessment of the physical condition index according to E.A. Pirogova and the assessment of physical working capacity using a step test. A total of 134 students were examined: 63 men and 71 women.

Results and conclusions. An analysis of the results shows that dividing students into functional groups according to the results of the PCI assessment may lead to error in determining the permissible limits of physical load. The use of load testing is more justified. Its results showed that 60 % of the students have a 'low' or 'below average' level of physical working capacity. The 'high' and 'above average' levels include students who have a temporary restriction or who are in the stage of remission; these students train additionally 2-3 times a week. They may be recommended to undergo a repeated medical examination in order to change their medical group. When conducting classes with the students of a special educational department on the basis of a functional approach, the limits of permissible physical load according to the results of step ergometry should be taken into account, and the principal and additional diagnoses of the learners should be analysed.

Keywords: *students, special education department, functional approach, nosology, physical condition index, step test, well-being training.*

Introduction. According to the literature, the tendency towards an increase in the number of students in special medical groups is fairly stable [4, 12]. Values from 16 to 50 % are encountered in the literature. When account is taken of the diseases involved, according to the data of the teachers of university physical education departments the predominant ones are diseases of the musculoskeletal system, diseases of the circulatory system, diseases of the respiratory organs and diseases of the eyes [4, 9]. According to medical statistics, in 2011 the learners most frequently placed on dispensary registration in the Russian Federation were those with diseases of the respiratory organs, of the genitourinary system and of the digestive organs [3]. Specialists are unanimous: health improvement is connected with increasing the physical activity of

such students. But a contradiction is observed between the recommendations for applying the means of health-improving physical culture in sports medicine and in the practice of the education system. Thus, the medical approach proposes strengthening medical monitoring of the state of students' health. It is recommended that programmes be developed and introduced whose main principles are the comprehensiveness of health-improving technologies during the period of study, an individual approach in accordance with the leading diseases identified, an increase in the involvement of young people in physical culture and sport, and the promotion of a healthy way of life [3]. Practitioners, however, note that the system of adaptive physical education is built on a residual principle and, as a rule, is either not conducted at all or is conducted at the discre-



tion of the physical education teachers [5, p. 37]. Each year the number of students of special medical groups who have two, three or more concomitant pathologies in their history increases. Their combination sets physical education teachers the difficult task of dosing the load and individually selecting the exercises [11]. The situation is aggravated by the passive attitude towards physical culture that gradually forms in senior schoolchildren and persists among students. Thus, a survey of first-year students showed that 34.2 % of the students of the special educational department had not taken part in physical education lessons in the 10th and 11th classes [6].

An analysis of the publications on the organisation of group classes in the special educational department shows that over the last 15-20 years the predominant direction has been the health-improving and rehabilitative one. At its basis lies the assessment of the energy potential of the body and subsequent health-improving training. The corrective component is included at the end of the main part or in the concluding part of the session. At the same time, the level of physical condition, the adaptive potential or other indicators make it possible to establish individual limits of permissible physical activity. It seemed to us of interest to study the possibilities of differentiating students assigned to a special medical group using the assessment of the physical condition index (PCI) according to E.A. Pirogova [10] (the non-load approach) and the assessment of functional reserves according to the results of step ergometry (the load approach).

Objective of the study is to identify the possibilities of distributing the students of a special medical group into functional classes using the assessment of the physical condition index (PCI) according to E.A. Pirogova.

Methods and structure of the study. The research was conducted in the autumn period of the

2025-2026 academic year. The object of the study was the students of a special educational department who, according to the results of medical monitoring, had been assigned to a special medical group. The method of E.A. Pirogova was used to assess the students' physical condition index. The following indicators were entered in the protocol: body length and mass, arterial pressure, heart rate at rest, age and sex. The assessment was carried out using the scale presented in Table 1 [8]. A total of 134 students were examined.

It is known that the assessment scale was developed on young healthy men and was subsequently refined for women. From our experience, the express assessment of the level of physical condition according to G.L. Apanasenko and L.A. Popova [1] is more reliable. At present, however, such an approach has limitations in mass examinations because of the prevalence of various respiratory infections, since vital lung capacity is measured with a dry spirometer.

Load testing was carried out using a two-stage step test [7]. For women the height of the step at the first load was 0.12 m and at the second 0.22 m. For men the height of the step was 0.2 and 0.3 m. The rate of ascent was 24 cycles per minute (96 signals of the metronome), and the duration of each load was 5 minutes. Heart rate was measured using pulse oximeters in a seated position over 15-20 seconds immediately after the completion of the load. No rest pause between the steps was provided for.

Results of the study and discussion. The results obtained from the assessment of the PCI by the method of E.A. Pirogova (the non-load method) are presented in Figure 1.

The method of assessing the PCI according to E.A. Pirogova showed that in 65 % of the male students of the special educational department the level of functional capabilities is 'low' or 'below average': the 'low' level – 17 % of students; 'below av-

Table 1. Scale for assessing the PCI

Physical condition index (PCI)	Values	
	Women	Men
High	0.576 and above	0.826 and above
Above average	0.476-0.575	0.676-0.825
Average	0.366-0.475	0.526-0.675
Below average	0.261-0.365	0.375-0.525
Low	0.157-0.260	0.374 and below

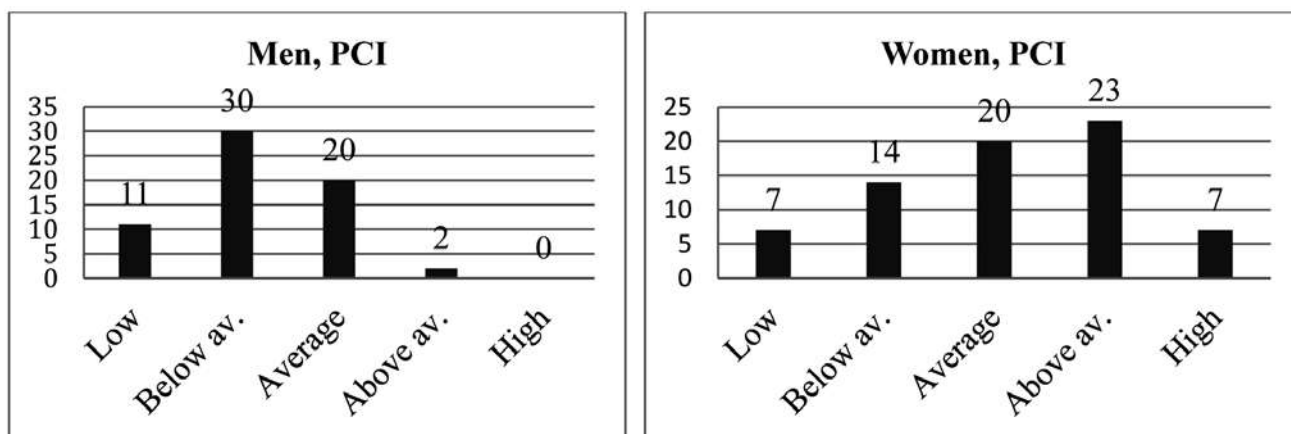


Figure 1. Results of the assessment of the PCI in the students (men and women)

erage' – 48 %; 'average' – 32 %; 'above average' – 3 %; 'high' – 0 %.

An analysis of the PCI and of the nosological forms of the students showed that the 'above average' level predominated among students with diseases of a temporary character (injuries of the musculoskeletal system, appendicitis). Among the students with levels from 'low' to 'average', a wide spectrum of diseases in the stage of remission was noted. It may therefore be said that the use of this method for dividing the male group into subgroups by functional level and for determining the limits of permissible physical load is justified.

An analysis of the results of the PCI assessment in the female students showed: the 'low' level – 10 %; 'below average' – 20 %; 'average' – 28 %; 'above average' – 32 %; and 'high' – 10 %. That is, 30 % of the female students were assigned to the 'low' and

'below average' subgroups. It should be noted that 32 % fell into the 'above average' subgroup. A comparison with the disease groups showed that the subgroup with the 'high' and 'above average' levels included female students who have restrictions on high physical load (130-150 bpm according to V.S. Farfel).

Let us highlight two aspects. The first is connected with the fact that some young women strive for a model appearance and therefore artificially restrict themselves in food, have insufficient muscle mass and an asthenic body type. Their arterial pressure is at the lower limit of normal or below it (hypotension). Such female students are erroneously classified into the subgroups with a 'high' or 'above average' PCI. Without the inclusion of additional investigations, the limits of permissible physical load will be determined incorrectly.

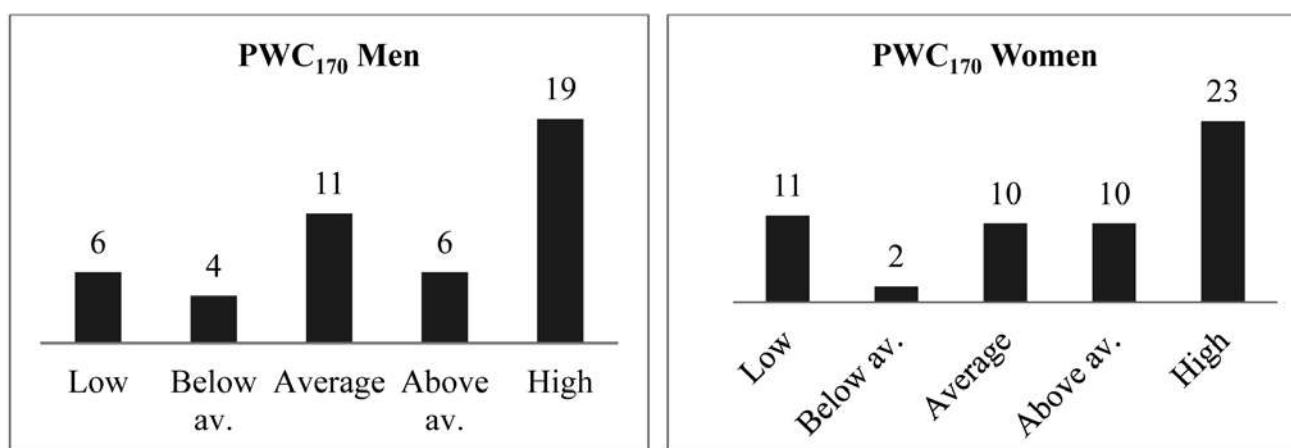


Figure 2. Results of the step ergometry of the students (men and women)



The second aspect is connected with the presence in 40-60 % of the students of a second or third diagnosis [1]. It is necessary to analyse the combinations of diseases and only then to assess the functional reserves of the students. For example, the principal diagnosis may be a disease of the eyes, of the musculoskeletal system, of the respiratory system or of the digestive organs, and only afterwards does the presence of additional diseases become apparent. In such female students, well-being during classes may deteriorate sharply. The teacher will be required to observe the students' reaction to a small load and subsequently to increase the load gradually.

Let us consider the results of step ergometry (load testing) (Figure 2).

A total of 54.3 % of the students were assigned to the 'low' and 'below average' levels. The 'average' level accounted for 23.9 %, 'above average' for 8.7 % and, finally, the 'high' level for 13 % of the students. A survey of the students who found themselves in the subgroups with the 'high' and 'above average' levels showed that these students are in the stage of remission or of temporary restriction, and that all of them train independently or in fitness clubs 2-3 times a week. Such students may be recommended to undergo an additional medical examination with a view to transferring to the preparatory or main educational department.

Let us analyse the results of the step ergometry of the female students. A total of 41.1 % were assigned to the 'low' level and 17.9 % to 'below average'. In sum, 59 % of the female students have substantially reduced functional capabilities.

The 'high' level accounted for 19.6 % of the women, 'above average' for 3.6 % and 'average' for 17.9 %. Among the women with the 'high' and 'above average' levels the situation is similar to the answers of the men. The majority of these female students train in fitness clubs. Some of them train with coaches. The recommendations are similar.

At the same time, both in men and in women attention may be drawn to the considerably larger number of students assigned to the subgroups with the 'low' and 'below average' levels according to the results of step ergometry.

A comparison of the diagrams of non-load and load testing shows substantial differences. Thus, the overall results of load testing – about 60 % of the students of the special educational department

have a 'low' or 'below average' level of functional reserves – presuppose, in a group form of classes, a moderate functional load in the main part of the session, from 110 to 130 bpm. This agrees well with the recommendations of other specialists [2]. Certain regimes of health-improving training cannot be recommended to students solely on the basis of the assessment of the PCI.

Conclusions. The distribution of students into functional classes on the basis of the assessment of the PCI according to E.A. Pirogova showed that the 'low' level is found in 17 % of men and 10 % of women, the 'below average' level in 48 and 20 %, the 'average' level in 32 and 28 %, the 'above average' level in 3 and 32 %, and the 'high' level in 10 % of women. A comparison of the results with the nosological groups of the learners showed that errors are possible in assessing the limit of permissible physical load.

An analysis of the structure of the functional classes of the students on the basis of the assessment of the results of physical working capacity using step ergometry showed that the 'low' level is found in 41.3 % of men and 41.1 % of women, the 'below average' level in 13 % of men and 17.9 % of women, the 'average' level in 23.9 % of men and 17.9 % of women, the 'above average' level in 8.7 % of men and 3.6 % of women, and the 'high' level in 13 % of men and 19.6 % of women. A comparison with the nosological groups showed that the probability of error in assessing the limit of permissible physical load in the learners is reduced.

References

1. Apanasenko G.L., Popova L.A. Meditsinskaya valeologiya. Seriya «Gippokrat». Rostov-na-Donu: Feniks, 2000. 248 p.
2. Balysheva N.V., Gorelov A.A., Rumba O.G. Regulirovaniye dvigatelnykh nagruzok studentov spetsialnoy meditsinskoy gruppy s narusheniyami serdechno-sosudistoy sistemy v protsesse zanyatiy ozdorovitelnoy fizicheskoy kulturoy. Kultura fizicheskaya i zdorovye. 2011. No. 4. Pp. 3-6.
3. Gorelov A.A., Rumba O.G., Kondakov V.L. O sostoyanii zdorovya studentov spetsialnoy meditsinskoy gruppy gumanitarnogo vuza. Vestnik Rossiyskogo gosudarstvennogo universiteta im. I. Kanta. 2008. No. 11. Pp. 101-105.



4. Goncharova O.V., Achkasov E.E., Sokolovskaya T.A. et al. Sostoyaniye zdorovya studentov vuzov Rossiyskoy Federatsii po dannym dispansernogo obsledovaniya 2011 g. Mediko-sotsialnaya ekspertiza i reabilitatsiya. 2013. No. 3. Pp. 10- 14.
5. Evseeva O.E., Evseev S.P. Tekhnologii fizkulturno-sportivnoy deyatel'nosti v adaptivnoy fizicheskoy kulture: ucheb'nik. Pod red. S.P. Evseeva. Moskva: Sport, 2016. 348 p.
6. Egorychev A.O., Egorycheva E.V. Algorit'm obucheniya studentov spetsial'nogo uchebnogo otdeleniya fizkulturnoy deyatel'nosti. Fizicheskoye vospitaniye i studencheskiy sport. 2025. V. 4. No. 2. Pp. 198-203.
7. Egorychev A.O., Egorycheva E.V. Otsenka rabotosposobnosti studentov spetsial'nogo uchebnogo otdeleniya na osnove step-ergometrii. Innovatsii v sportivnoy nauke: opyt pokoleniy i novye tekhnologii: Materialy Vserossiyskoy nauchno-prakticheskoy konferentsii s mezhdunarodnym uchastiem, Moskva, 08 fevralya 2024 goda. Moskva: Rossiyskiy ekonomicheskiy universitet imeni G.V. Plekhanova, 2024. Pp. 505-510.
8. Karaulova L.K., Krasnoperova N.A., Rasulov M.M. Fiziologiya: ucheb. posobiye dlya stud. vyssh. ucheb. zavedeniy. Moskva: Izdatelskiy tsentr «Akademiya», 2009. Pp. 321-322.
9. Kotkova L.Yu., Shaymardanova L.Sh., Evseeva A.R. Metodicheskoye obespecheniye zanyatiy po elektivnym distsiplinam (modulyam) po fizicheskoy kulture i sportu so studentami spetsial'noy meditsinskoy gruppy. Pedagogiko-psikhologicheskiye i mediko-biologicheskiye problemy fizicheskoy kultury i sporta. 2022. V. 17. No. 2. Pp. 101-106.
10. Pirogova E.A., Ivashchenko L.Ya., Strachko N.P. Vliyaniye fizicheskikh uprazhneniy na rabotosposobnost i zdorovye cheloveka. Kiev: Zdorovye, 1986. 152 p.
11. Tolist'nov B.G. Analiz struktury zabolevayemosti studentov spetsial'nykh meditsinskikh grupp. Upravlencheskiy uchet. 2025. No. 7. Pp. 344- 350.
12. Tretyakov A.A., Shcherbin D.V., Bodakin A.V., Malikov A.Yu. Monitoring fizicheskogo sostoyaniya studentov v protsesse obucheniya v vuze. Teoriya i praktika fizicheskoy kultury. 2024. No. 8. Pp. 63-64.



Areas of the social integration of young athletes based on a study of the opinions of sports educators

UDC 796.01



Dr. Hab., Professor **O.E. Ponimasov**^{1, 2}

PhD, Associate Professor **S.V. Solomatin**^{3, 4}

¹The Russian Presidential Academy of National Economy and Public Administration, Moscow

²The Herzen State Pedagogical University of Russia, Saint Petersburg

³Centre of Sport and Education 'Sambo-70' of Moskomspor, Moscow

⁴Moscow Institute of Modern Academic Education, Moscow

Corresponding author: o-pony@mail.ru

Received by the editorial office on 17.02.2026

Abstract

Objective of the study is to examine the direction of the social integration of young athletes on the basis of a survey of sports educators.

Methods and structure of the study. An anonymous survey was conducted with the aim of assessing sports educators' understanding of the value of the social integration of young athletes. The study involved 78 coaches and methodologists in the sports practised at the «Sambo-70» Centre for Sport and Education.

Results and conclusions. The lack of awareness among sports educators of the existing measures and forms of socialisation points to the absence of a centralised system for managing the processes of socialisation in the preparation of the sports reserve. The level of awareness of the forms and methods of socialisation is statistically significantly related to the professional experience of sports educators.

Keywords: *young athletes, forms and methods of socialisation, sports educators, social integration, professional experience.*

Introduction. Alongside the attainment of the heights of sporting mastery, sport exerts a substantial influence on the athlete's integration into the social environment and on personal development. At the same time, the intensity of the training process and the high psychological and physical loads have a negative effect on young athletes' full mastery of social norms, rules and values [2]. The impact of the factors listed is negative for the mastery of one's own system of values and ideals and for the self-realisation of the personality when active sports participation is combined with obtaining an education and with the psychological maturation of the young athlete.

The studies carried out have demonstrated the need for psychological support for adolescents engaged in sport, since defeat in sporting activity may be perceived by them as a critical life failure. The development of effective psychological and social support that takes account of the specific features of the formation of young athletes implies the management of the value-and-meaning sphere of adolescents in the course of sporting, educational and leisure activity [4].

Although, alongside the family, the school and informal associations, the sports and training envi-

ronment is a powerful means of socialisation, state-funded general education institutions with a sporting focus are not regarded as an institution of the social upbringing of young athletes [1].

The relevance of studying the problem of social integration within the system of preparing the sports reserve is due to the absence of comprehensive systemic programmes combining the use of the means of the sporting micro-society and of the educational environment [5]. Of particular importance are the social values and needs of young athletes in the sporting sphere – setting a record, winning a tournament, and raising the level of sporting qualification [3].

Objective of the study is to examine the direction of the social integration of young athletes on the basis of a survey of sports educators.

Methods and structure of the study. As part of the study, an anonymous survey was conducted with the aim of assessing sports educators' understanding of the value of the social adaptation of young athletes. The survey results formed the basis for the development and introduction of programmes integrating the sporting, educational and leisure activity of the adolescents training at the «Sambo-70» Centre for Sport and Education.



The study involved 78 coaches and methodologists in the sports practised at the Centre, as well as specialists in physical culture and sport from universities of a sports and pedagogical profile. The diversity of the composition of the study participants ensured the representativeness of the specialists' opinions on the question under examination. A proportion of those surveyed (20 %) were representatives of sports clubs, and more than half of the respondents were highly qualified athletes.

The organisation of the work included a theoretical analysis of the problem, the development of the research methods, data collection and the processing of the data sets obtained. The primary data collection was carried out by means of an anonymous online questionnaire, which made it possible to achieve the widest coverage of respondents and ensured the confidentiality of the responses.

In order to study the process of the social adaptation of athletes as a complex, multi-structural system, the method of systems analysis was applied, which made it possible to identify the structural components of the adaptation of young athletes. These included the individual characteristics of the athlete, the structural components of the social environment and the institutional factors of socialisation, together with their interrelations and functions.

Descriptive statistics were used to summarise and present the results, including frequency analysis, the calculation of mean values and percentages, and the calculation of the chi-squared test (χ^2). The data analysis was carried out using Microsoft Excel and Statistica software.

Results of the study and discussion. An analysis of the results obtained made it possible to examine comprehensively sports educators' understanding of the foundations of social integration, and to identify the key problems and the priority areas for integrating sport and the socialisation of young athletes. A total of 77.6 % of educators defined social adaptation as an 'extremely important' element of the system of the socialisation of young athletes; 12.0 % of respondents considered it 'sufficiently significant but not a priority', and fewer than 1.0 % – 'not significant' in an athlete's career. The survey results presented indicate a high level of awareness among respondents of the significance of the problem and point towards the development and introduction of effective measures of social support for young athletes.

The effective development and introduction of forms and methods of socialisation require a unified approach on the part of sports educators to this problem. The study revealed certain discrepancies in respondents' interpretation of the term 'socialisation of young athletes'. The most widespread definitions were: 'the successful integration of the athlete into the social environment during sports participation and outside the training process' (38.6 %) and 'the athlete's ability to combine sport with other spheres of life, such as education, family, leisure activity and the mastery of general cultural values' (28.5 %). The pattern of distribution of the responses indicates respondents' understanding of the multidimensional nature of socialisation, which extends beyond competitive and training activity and includes the compre-

Table 1. Level of awareness and involvement of sports educators depending on length of service

Awareness	Length of service, years				Total
	≤ 5	6-10	11-20	≥ 20	
Not aware	12	8	4	2	26
Have heard of them	4	6	11	12	33
Aware, not involved	0	1	3	7	11
Aware, involved	0	0	5	3	8
Total	16	15	23	24	78

Table 2. Principal social problems in sports participation

Range of issues	Number of responses	
	n	%
Imbalance between sport and education	33	42.3
Social circle limited to sport	22	28.0
Insufficient communication skills	15	19.7
Psychological overload and stress	28	35.3
Difficulties in planning for the future	31	39.3
Limited communication with the family	14	18.0
Other	2	2.3



hensive integration of the personality into various social spheres throughout the athlete's life.

The following hypotheses were formulated. The null hypothesis (H_0): the level of specialists' knowledge does not depend on their length of service. The alternative hypothesis (H_1): the professional experience and the level of knowledge of sports educators are linked by a statistically significant relationship.

In order to study the relationship between length of service and the level of knowledge of sports educators, the chi-squared test (χ^2) was introduced. The value of χ^2 obtained was 124.2 with 12 degrees of freedom (df). Since the value $p < 0.05$ was considerably below the standard significance level ($\alpha = 0.05$), the null hypothesis was rejected. This indicates a statistically significant relationship between length of service and the level of knowledge of sports educators (Tables 1 and 2).

For the effective work of the coaching staff and the involvement of young athletes in social life, knowledge of the forms and methods of social adaptation is an extremely important factor. The analysis carried out within the study of respondents' level of knowledge of the content of the social upbringing implemented in the course of mastering sporting expertise showed that, despite the recognition of the importance of the social adaptation of athletes, the level of sports educators' command of the methods of social influence requires further improvement. A fifth of the respondents (19.4 %) reported that they had no understanding of the forms and programmes of social upbringing; 36.7 % had heard of them but were not familiar with their content and the specifics of their implementation; and only 11.3 % of sports educators reported direct participation in their implementation.

The data obtained indicate the absence of a unified, structured and effective system of the social upbringing of young athletes, which considerably limits the effective use of the available resources and reduces the degree of learners' involvement in the process of socialisation.

For the development of effective measures of social integration, the greatest importance attaches to identifying the principal difficulties encountered by athletes in the course of sports preparation. The study and identification of problem issues ensures the effective development of social measures that improve the quality of life and education and the integration of young athletes into social institutions. The survey results indicate that the greatest difficulties encountered by young athletes in the context of social integration are the disruption of the balanced relationship

between sport and education (42.3 %), the absence of plans for the future (39.3 %), and the overload and stress accumulated under the influence of systematic physical loads (35.3 %).

The data obtained reveal the complex nature of the range of issues surrounding socialisation, since they extend far beyond sporting activity and shape the social development, psychological state and realisation of the life interests of young athletes.

Conclusions. The majority of sports educators recognise the high significance of the socialisation of young athletes, understanding by this the successful integration into the social environment during sports participation and outside the training process. Such a definition reflects the concept of the dual orientation of a sporting career and underlines the need for an integrative approach. The identified lack of awareness among sports educators of the existing measures and forms of socialisation points to the fragmentary nature of the information environment and to the absence of a centralised system for managing the processes of socialisation in the preparation of the sports reserve. The level of awareness of the forms and methods of socialisation is statistically significantly related to the professional experience of sports educators.

References

1. Baranov V.A., Lubysheva L.I. Sport vysshikh dostizheniy: sotsiologicheskiy analiz missii i potentsiala sporta. Teoriya i praktika fizicheskoy kultury. 2021. No. 3. Pp. 3-5.
2. Petrov S.I. Integratsiya obrazovatelnoy, nauchnoy i sportivnoy deyatel'nosti pri podgotovke kadrov v oblasti fizicheskoy kultury i sporta. Teoriya i praktika fizicheskoy kultury. 2023. No. 6. Pp. 36-38.
3. Ponimasov O.E., Belyakova M.Yu., Sayganova E.G., Mironov A.O. Povedencheskiye proyekt-sii opyta zanyatiy sportom na dvigatel'nyuyu aktivnost' studentov v period obucheniya v vuze. Teoriya i praktika fizicheskoy kultury. 2025. No. 7. Pp. 77-79.
4. Spiridonov E.A., Mironov A.O., Ponimasov O.E., Sayganova E.G. Sportivnaya deyatel'nost' kak sredstvo formirovaniya antistressovoy ustoychivosti studentov v obrazovatel'noy srede. Teoriya i praktika fizicheskoy kultury. 2024. No. 7. Pp. 70-72.
5. Frunze V.V., Kolesnikov N.V., Ponimasov O.E. Effektivnoye ispol'zovaniye upravlencheskikh resursov v realizatsii proyekta «Sport – norma zhizni». Teoriya i praktika fizicheskoy kultury. 2024. No. 6. Pp. 37-39.



The use of artificial intelligence at the stages of sports preparation

UDC 796.015



PhD **E.N. Skarzhinskaya**¹

PhD **A.V. Ermakov**²

V.A. Beresneva^{2, 3}

PhD, Associate Professor **M.A. Novoselov**²

¹Sports School 'Centre of Digital Sports', Surgut

²The Russian University of Sport «GTSOLIFK», Moscow

³Sports-Methodological Centre 'Department of Esports'

Corresponding author: skar_e@mail.ru

Received by the editorial office on 01.06.2026

Abstract

Objective of the study is to provide a scientific rationale for the integration of artificial intelligence technologies into the normative model of sports preparation and to develop a model of their application at the stages of the long-term preparation of athletes.

Methods and structure of the study. An analysis of foreign and Russian scientific works on the topic of the study was carried out.

Results and conclusions. The possibilities of applying artificial intelligence technologies within the system of sports preparation are examined in the context of the federal standards of sports preparation. On the basis of an analysis of foreign and Russian research, a model of the use of artificial intelligence at the stages of initial preparation, sports specialisation, the improvement of sporting mastery and higher sporting mastery has been developed. It is shown that the application of artificial intelligence contributes to increasing the effectiveness of monitoring, data analysis, the individualisation of the training process and the support of the coach's management decisions. The expediency of giving normative status to the athlete's digital footprint and to intelligent analytical systems within the federal standards of sports preparation is substantiated.

Keywords: *artificial intelligence, stages of sports preparation, federal standards of sports preparation, digital environment, athlete's digital footprint, sports of the industrial society, sports of the information society, data analysis, computer vision, data-driven management.*

Introduction. The relevance of the study is determined by the digital transformation of physical culture and sport, which provides for the creation of a unified digital environment and the introduction of data-driven management [6]. Contemporary research substantiates the need for a comprehensive assessment of the physical, functional, technical, cognitive, sensorimotor and other characteristics of the athlete, the objective analysis of which has become possible thanks to the development of digital technologies and artificial intelligence. At the same time, the federal standards of sports preparation currently in force regulate the assessment predominantly of the physical qualities of athletes and do not provide a normative basis for the systematic recording of other characteristics that exert a substantial influence on sporting performance.

The development of the digital infrastructure of the sector, including the Federal State Information System «Sport», electronic athlete passports and the technologies of data accumulation and processing, creates the necessary conditions for the introduction of artificial intelligence technologies into the system of sports preparation. Under these conditions there arises a need for the scientific substantiation of the improvement of the federal standards of sports preparation through the integration of artificial intelligence technologies at the various stages of the long-term preparation of athletes.

Objective of the study is to provide a scientific rationale for the integration of artificial intelligence technologies into the normative model of sports preparation and to develop a model of their application at the stages of the long-term preparation of athletes.



Methods and structure of the study. An analysis of foreign and Russian scientific works on the topic of the study was carried out.

Results of the study and discussion. Foreign research. In foreign research, artificial intelligence is regarded as a means of improving sports preparation through data analysis, forecasting and decision support. The most fully developed areas are the application of machine learning methods in sporting selection, the assessment of the physical development of athletes and the design of individualised preparation programmes [12, 14].

Considerable attention is paid to the use of decision support systems, time series analysis and predictive analytics for the assessment of the functional state of athletes, the monitoring of training effects and the forecasting of sporting performance. The technologies of computer vision, video analytics, the analysis of biomechanical indicators, neural networks and deep learning methods are being actively developed; these ensure the objective assessment of movement technique, competitive activity and sporting results.

The summarising studies of O. Bodemer [11] and S. Pashaie, S. Mohammadi and H. Golmohammadi [13] indicate that artificial intelligence is regarded not only as a set of digital tools but also as the technological foundation for the personalisation of sports preparation and for increasing the effectiveness of the management of the training process. At the same time, the authors emphasise that the introduction of AI must be accompanied by observance of the ethical principles of its application, including interaction within the 'coach – artificial intelligence' and 'athlete – artificial

intelligence' systems, the preservation of the leading role of the coach in decision-making, the assurance of the quality of the source data and the protection of athletes' personal data.

Thus, foreign research demonstrates the high potential of artificial intelligence technologies for addressing a wide range of tasks in sports preparation. At the same time, it is predominantly oriented towards the development of individual digital solutions and does not address the questions of their integration into the normatively regulated system of the long-term preparation of athletes. This scientific gap determines the need to develop a model of the application of artificial intelligence with reference to the Russian system of sports preparation.

Russian research forms the scientific and methodological basis for the application of artificial intelligence under the conditions of the digital transformation of sport. The works of M.O. Charyeva, V.A. Lednev and E.N. Skarzhinskaya reveal digital sports as an independent direction in the development of the sports sector [10]; M.A. Novoselov substantiates the need to form new competences among specialists in the field of working with data [4]; and A.K. Slozhenikin and A.M. Shchepot'yev consider the digital footprint as the basis for constructing model characteristics of athletes [8].

The practical aspects of the application of artificial intelligence are investigated in the works of N.G. Taranina, M. Alahmad, P.P. Nikolaev and S.V. Levchenko, devoted to the use of AI in sporting selection, the analysis of training and competitive activity, the monitoring of functional state, strategic planning and decision support. The authors also draw attention to the need

Table. Practical recommendations on the use of AI at the stages of sports preparation

Stage of sports preparation	What the coach may use	For which tasks	Management outcome
Stage of initial preparation	Machine learning; digital profile; cognitive and motor tests	Primary selection; analysis of reaction, attention, coordination and motivation	Well-founded selection; early individualisation; primary digital footprint
Educational and training stage (stage of sports specialisation)	Load monitoring; time series analysis; recommender algorithms	Monitoring of load and functional state; identification of overload; adjustment of the plan	Individualisation of preparation; reduction of the risk of overtraining; tracking of dynamics
Stage of the improvement of sporting mastery	Computer vision; video analytics; biomechanical analysis; predictive models	Analysis of technique and tactics; identification of performance factors; analysis of competitions	Optimisation of technique and tactics; increase in competitive effectiveness
Stage of higher sporting mastery	Intelligent analytical systems; predictive analytics; AI assistants for the coach	Modelling of opponents and situations; choice of tactics; forecasting of the result; risk prevention	Better-founded decisions by the coach; personalisation of preparation for competitions



Proposed model for the incorporation of artificial intelligence into the federal standards of sports preparation

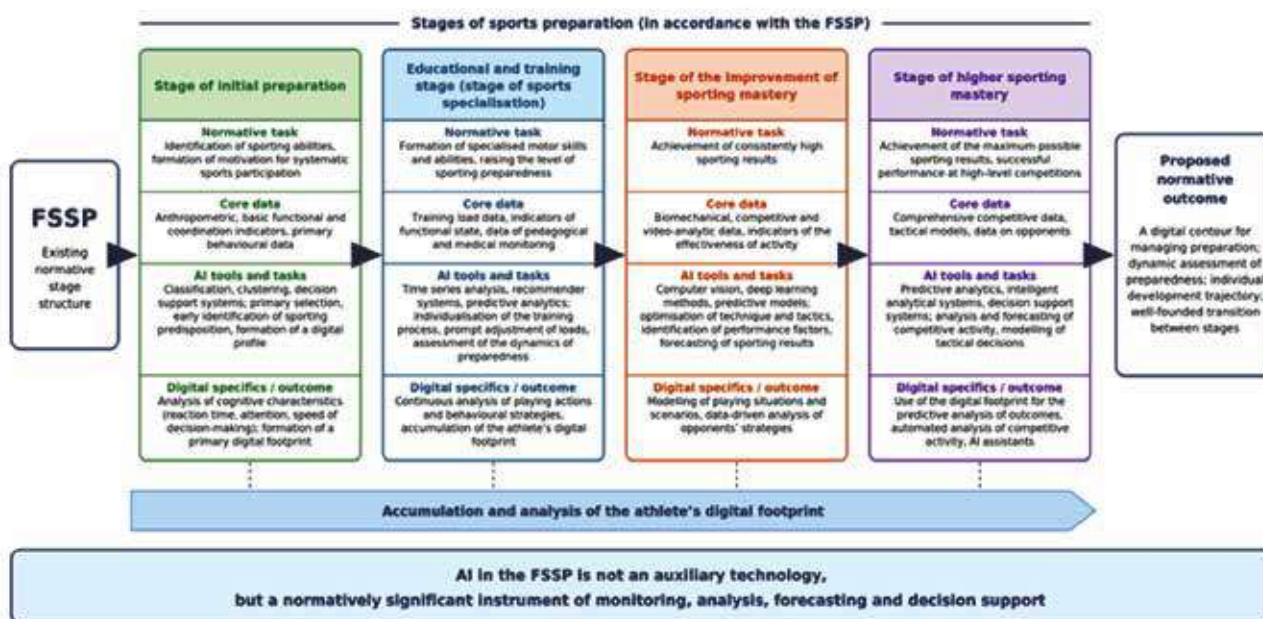


Figure. Model of the application of artificial intelligence technologies at the stages of sports preparation

for ethical support in the introduction of artificial intelligence technologies into sporting practice [1, 3, 9].

The applied possibilities of AI are also demonstrated using the material of individual sports. K.V. Pobochina reveals the prospects for its use in equestrian sport [5], while E.V. Rego and D.S. Evtropkova show the influence of AlphaGo-level systems on the improvement of preparation in intellectual sports [7].

Thus, Russian research reveals the technological, personnel, methodological and sectoral aspects of the application of artificial intelligence; however, it scarcely addresses the questions of its normative integration into the federal standards of sports preparation as an instrument of monitoring, analysis, forecasting and decision support.

The analysis of scientific research carried out and the digital services developed – the service for physical education lessons and sports preparation in physical sport, the computer vision programme MotionAnalyzer and the Cognitive Motor Training service – made it possible to determine the artificial intelligence technologies that are expedient for application at the various stages of sports preparation (see the Figure).

The model proposed reflects the concept of the normative application of artificial intelligence technologies at the stages of sports preparation in accordance with the federal standards of sports preparation. It is based on the interrelation of the stages of sports

preparation, the sources of data, the technologies of artificial intelligence and the tasks of the information and analytical support of the coach's activity.

The sources of data are determined by the content of the training process and of competitive activity and include the results of objective monitoring, as well as the athlete's digital footprint formed in the course of sports preparation, including participation in competitions, among them competitions in digital and technological sports [2]. Taken together, these data form a unified data space that enables the application of artificial intelligence technologies for monitoring the state of the athlete's preparedness, analysing the effectiveness of the training process, forecasting sporting results and providing information and analytical support for coaching decisions.

The specification of the functions of artificial intelligence technologies, of the data used and of the tasks addressed at each stage of sports preparation is presented in the Table.

The specification of the functions of artificial intelligence with reference to the tasks of each stage is presented in the Table. Thus, the application of artificial intelligence should be directed towards supporting the activity of the coach at all stages of sports preparation.

Conclusions. A model of the normative integration of artificial intelligence into the federal standards



of sports preparation has been substantiated, ensuring the application of intelligent data analysis technologies at all stages of the preparation of athletes. The practical significance of the study consists in the possibility of using the model proposed in improving the federal standards of sports preparation and in introducing artificial intelligence technologies into the processes of planning, monitoring and evaluating the training process while preserving the leading role of the coach.

References

1. Alahmad M. Matematicheskaya obrabotka dannykh i iskusstvennyy intellekt v sporte. Sotsialno-pedagogicheskiye voprosy obrazovaniya i vospitaniya: Materialy Vserossiyskoy nauchno-prakticheskoy konferentsii s mezhdunarodnym uchastiem, Cheboksary, 10 fevralya 2026 goda. Cheboksary: OOO «Izdatelskiy dom “Sreda”», 2026. Pp. 399-400. EDN: QJKFQK.
2. Beresneva V.A. Normativno-pravovoye obespecheniye distantsionnoy sportivnoy podgotovki v tsifrovyykh i tekhnologichnykh vidakh sporta. Tsifrovaya transformatsiya sporta (traditsionnyy sport, kompyuternyy sport, fidzhital-sport, gonki dronov, sportivnoye programmirovaniye): Materialy Vserossiyskoy zaochnoy nauchno-prakticheskoy konferentsii, Moskva, 15 dekabrya 2025 goda – 14 2026 goda. Moskva: Rossiyskiy universitet sporta «GTSOLIFK», 2026. Pp. 26-35. EDN: XRCJFQ.
3. Nikolaev P.P., Levchenko S.V. Ispolzovaniye iskusstvennogo intellekta v sporte. Tendentsii razvitiya nauki i obrazovaniya. 2024. No. 107-7. Pp. 135-137. DOI: 10.18411/trnio-03-2024-372. EDN: EYWCD.
4. Novoselov M.A. Voprosy podgotovki kadrov dlya tsifrovoy transformatsii sporta. Kompyuternyy sport (kibersport): problemy i perspektivy razvitiya: Materialy Vserossiyskoy nauchno-prakticheskoy konferentsii, Moskva, 08 dekabrya 2022 goda. Moskva: Rossiyskiy universitet sporta «GTSOLIFK», 2022. Pp. 122-126. EDN: CKUVYY.
5. Pobochina K.V. Primeneniye iskusstvennogo intellekta v konevodstve i konnom sporte. Simvol nauki: mezhdunarodnyy nauchnyy zhurnal. 2025. V. 1. No. 12-1. Pp. 88-90. EDN: TEJKRX.
6. Rasporyazheniye Pravitelstva RF ot 18.03.2026 No. 528-r «Ob utverzhdenii strategicheskogo napravleniya v oblasti tsifrovoy transformatsii fizicheskoy kultury i sporta na period do 2030 goda». URL: https://www.consultant.ru/document/cons_doc_LAW_529230/ (date of access: 15.04.2026).
7. Rego E.V., Evtropkova D.S. Primeneniye tekhnologiy iskusstvennogo intellekta v trenirovochnom protsesse v intellektualnykh vidakh sporta na primere igry go. Nauchnoye obozreniye. Pedagogicheskiye nauki. 2024. No. 4. Pp. 16-20. DOI: 10.17513/srps.2540. EDN: ELJORR.
8. Slozhenikin A.K., Shchepot'yev A.M. Modelnye kharakteristiki kibersportsmenov na osnove tsifrovyykh sledov v videoigrakh. Rossiyskiy zhurnal informatsionnykh tekhnologiy v sporte. 2025. V. 2. No. 3. Pp. 26-37. DOI: 10.62105/2949-6349-2025-2-3-26-37. EDN: CFLTKK.
9. Taranina N.G. Osnovnye napravleniya primeneniya iskusstvennogo intellekta v sporte. Molodezh i nauchno-tekhnicheskyy progress: Sbornik dokladov XVII mezhdunarodnoy nauchno-prakticheskoy konferentsii studentov, aspirantov i molodykh uchenykh. V 2-kh tomakh, Gubkin, 04 aprelya 2024 goda. Gubkin: OOO «Assistent plyus», 2024. Pp. 148-152. EDN: IQRBAN.
10. Charyeva M.O., Lednev V.A., Skarzhinskaya E.N. Tsifrovyye vidy sporta: innovatsii i tekhnologii. 2nd ed., suppl. Moskva: Moskovskiy finansovo-promyshlennyy universitet «Sinergiya», 2025. 142 p. ISBN 978-5-4257-0675-1. DOI: 10.37791/978-5-4257-0675-1-2025-1-142. EDN: SEITCW.
11. Bodemer O. Enhancing individual sports training through artificial intelligence: A comprehensive review. Authorea Preprints. 2023. URL: <https://www.techrxiv.org/doi/pdf/10.36227/techrxiv.24005916>.
12. Lee Y.H. et al. Essential elements of physical fitness analysis in male adolescent athletes using machine learning. PLOS ONE. 2024. V. 19. No. 4. P. e0298870.
13. Pashaie S., Mohammadi S., Golmohammadi H. Unlocking athlete potential: The evolution of coaching strategies through artificial intelligence. Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology. 2024. P. 17543371241300889.
14. Yuwono C. et al. A Machine Learning-Based Framework for Optimizing Sports Talent Identification and Development. Cuestiones de Fisioterapia. 2025. V. 54. No. 2. Pp. 3934-3952.



Resource potential of the active-game educational environment of physical education

UDC 796.11



PhD, Associate Professor **A.M. Fokin**

The Herzen State Pedagogical University of Russia, Saint Petersburg

Corresponding author: studio_grand@list.ru

Received by the editorial office on 17.02.2026

Abstract

Objective of the study is to identify the didactic possibilities of the active-game educational environment on the basis of the implementation of the concept of gamification of physical education for students of pedagogical specialities.

Methods and structure of the study. Theoretical, empirical and statistical research methods were used to achieve the stated objective. The methods of statistical data processing involved the use of Student's t-test to determine the significance of differences in independent samples, and Pearson's chi-squared test (χ^2) to demonstrate the statistical significance of the experimental results.

Results and conclusions. According to all the criteria applied, the experimental groups show more significant positive changes in the levels of formation of the educational environment than the control groups. The didactic potential of gamification is determined by the possibility of its application in organising the educational process in accordance with the active-game paradigm of physical education.

Keywords: *physical education, active-game educational environment, concept of gamification, didactic possibilities.*

Introduction. Active-game learning refers to the methods of the universal use of the means of sports and outdoor games to address the tasks of the physical education of learners [1]. The active-game form of organising learning activities is only one element of a large-scale active-game didactic system consisting of interconnected process segments [3]. Whereas the teaching of sports and outdoor games employs the game method as a means of the educational process, gamification turns learning itself into a game process [4].

Both strategies are aimed at achieving similar learning objectives and contribute to the engagement and sustained motivation of students. Nevertheless, a gamified environment and the teaching of sports and outdoor games differ in their approaches to structuring the educational process.

The teaching of sports and outdoor games may be structured around specific topics and learning modules without the need to create an active-game educational environment; gamification requires the entire structure of learning to be adapted to a game system

[5]. Thus, a gamified environment provides greater integrativeness in the implementation and modification of physical education so as to make it responsive to the aims and needs of all learners [2].

Objective of the study is to identify the didactic possibilities of the active-game educational environment on the basis of the implementation of the concept of gamification of physical education for students of pedagogical specialities.

Methods and structure of the study. Theoretical, empirical and statistical research methods were used to achieve the stated objective.

The theoretical methods included the study of scientific, philosophical, sociological and psychological-pedagogical literature in order to establish the state of development of the problem of the educational environment; a retrospective and comparative analysis of various views on the research problem; the substantiation of the criteria, indicators and levels of formation of the educational environment; the methods of analogy and pedagogical modelling for the development of a pedagogical system for shaping the educational



environment; and the methods of generalisation and systematisation for formulating the conclusions.

The empirical methods were interviews, discussions, questionnaires, testing and pedagogical observation.

The methods of statistical data processing involved the use of Student's t-test to determine the significance of differences in independent samples, and Pearson's chi-squared test (χ^2) to demonstrate the statistical significance of the experimental results.

At the formative stage of the experiment, a model of the active-game educational environment of physical education was developed, based on the following segmental components: classroom sessions, student public sports organisations, mass sports work, volunteering activity, and an interactive educational segment.

At the implementation stage of the experiment, the modelling of the innovative model of the active-game educational environment was managed, together with the methodological support and the material and technical provision of the educational process.

At the evaluation stage of the trial of the active-game educational environment, monitoring was carried out of the modes and nature of communication between the subjects of the educational process within the various segmental components of the environment: 'teacher – student', 'student – academic department', 'member of the refereeing panel – sports team', 'team captain – team of players', 'student club officer – sports organiser', 'supporter – athlete', 'volunteer – participants in a sporting event'.

The analytical stage of the trial included the analysis and interpretation of the results of modelling the active-game educational environment within the process of the physical education of students. At this stage, the results and effects obtained were discussed at scientific and practical conferences and seminars, and practical recommendations were issued for the introduction of the research findings into the practice of student physical education.

Results of the study and discussion. An analysis of the driving forces behind, and the incentives for, improving the process of physical education as the object of the study showed its connection with the constant search for directions in which to modify the resource basis: the educational infrastructure, and the scientific and practical routes, means, approaches and technologies for increasing the effectiveness of the educational process.

The process and content of the expert appraisal of the university's active-game educational environment included an analysis of certain areas of innovative transformation: the formation of a competence-oriented environmental model of physical education; the modelling of the organisational and pedagogical conditions for the effective functioning of the active-game educational environment; the formation of ways of solving educational tasks through the use of the structural constituents of the educational process in physical education; the formation of a segment-and-component structure of the active-game educational environment; the modernisation of the conditions and methods for developing the active-game activity and constructive competences of students; and the formation of a physical culture and sports student community as a subject of the gamification of physical education.

Using the methods of systems management, the intervals of index values corresponding to particular levels of formation of the active-game educational environment were determined.

As the data show, according to all the criteria applied the experimental groups demonstrate more significant positive changes in the levels of formation of the educational environment than the control groups. Since the samples of the experimental and control groups are random and independent, the members of each sample are also independent of one another. Pearson's chi-squared test (χ^2) was used in the study to test the hypotheses. The properties of the educa-

Table. Comparative characteristics of the procedural indicators of the didactic environmental conditions for the implementation of physical education

Indicator (index)	Differentiated thematic learning		Active-game environment		p
	x	σ	x	σ	
Mobility	3.32	1.34	6.82	1.98	<0.05
Interactivity	5.78	2.05	8.12	1.72	<0.05
Stability	7.9	2.4	8.4	1.43	<0.05
Individual approach	5.8	1.87	8.4	1.87	<0.05
Variability	3.7	1.95	6.8	2.64	<0.05



tional environment were measured on an ordinal scale with four levels: initial, enhanced-developmental, steadily developmental, and innovative.

An analysis of the expert assessments of the levels of formation of the conditions of differentiated thematic learning in the control groups also showed positive shifts; these, however, proved to be less significant.

Scale is one of the structural and substantive characteristics of the active-game educational environment and encompasses the subject-object domain and the multifaceted processes and phenomena that form the basis of educational activity. When the indicator of scale is compared, it becomes evident that the active-game educational environment is positioned as sufficiently capacious and endowed with considerable didactic possibilities. This stimulates the subjects of the educational process towards greater activity and towards the free mastery of all types of educational competences in an active-game form.

The value character of the active-game educational environment characterises its significance as a local structure within the system of learners' educational values and reveals the hierarchical position of environment-based physical education among the other educational components that exert a pedagogical influence on the student's personality.

The didactic potential of gamification is determined by the possibility of its application in organising the educational process in accordance with the active-game paradigm of physical education. The use of active-game technologies in physical education makes it possible to move from the linear to the variable development of physical qualities and the formation of motor skills, to activate active-game activity significantly, to increase learners' motivation for physical activity, and to model unique environmental conditions for the formation of independent game thinking integrated with motor role-based activity.

The use of game technologies in physical education generates an active-game educational environment characterised by the high universality of game algorithms possessing 'scalability' irrespective of spatial and temporal parameters. In the context of the self-realisation of a harmoniously developed and active personality, the organisational and pedagogical conditions for realising the didactic potential of gamification are: the organisation and functioning of the environmental components of the active-game educational environment on the basis of active-game technologies in accordance with the principles of openness, scale

and integrativeness; the predominance of interactive self-directed learning with feedback between the subjects of the educational process; the organisation of independent work on developing the physical qualities, game skills, and social and professional competences of learners; and the social relatedness of physical education.

Conclusions. The content of the concept of the gamification of physical education determines the functional and resource compatibility of the environmental segments of the active-game process, oriented towards the connectedness and synergy of the content of the active-game educational environment.

The segmentation of the constituent components and the differentiation of tasks form the analytical abilities of the participants in the active-game educational environment and mutually synthesise the formation of competences. This achieves an integrative effect of the cascading improvement of students' sociocultural and professional competences, brought about by the synthesis of the partial constituents of the active-game educational environment.

References

1. Baranov V.A., Lubysheva L.I. Sport vysshikh dostizheniy: sotsiologicheskii analiz missii i potentsiala sporta. *Teoriya i praktika fizicheskoy kultury*. 2021. No. 3. Pp. 3-5.
2. Frunze V.V., Kolesnikov N.V., Ponimasov O.E. Effektivnoye ispolzovaniye upravlencheskikh resursov v realizatsii proyekta "Sport – norma zhizni". *Teoriya i praktika fizicheskoy kultury*. 2024. No. 6. Pp. 32-34.
3. Mironov A.O., Ponimasov O.E., Spiridonov E.A., Khutin S.A. Formirovaniye menedzhment-kompetentsiy studentov upravlencheskikh spetsialnostey sredstvami fizicheskogo vospitaniya. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 12. Pp. 83-85.
4. Ponimasov O.E., Belyakova M.Y., Saiganova E.G., Mironov A.O. Povedencheskiye proyekt-sii opyta zanyatiy sportom na dvigatelnyuyu aktivnost studentov v period obucheniya v vuze. *Teoriya i praktika fizicheskoy kultury*. 2025. No. 7. Pp 70-72.
5. Spiridonov E.A., Mironov A.O., Ponimasov O.E., Sayganova E.G. Sportivnaya deyatel'nost kak sredstvo formirovaniya antistressovoy ustoychivosti studentov v obrazovatel'noy srede. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 7. Pp. 39-41.



Methods for evaluating the effectiveness of sports and correctional activities for children with intellectual disabilities

UDC 796/799

PhD, Associate Professor **L.A. Parfenova**¹

PhD, Associate Professor **E.V. Burtseva**¹

Graduate student **R.R. Giniyatullin**¹

¹Volga Region State University of Physical Culture, Sports and Tourism, Kazan

Corresponding author: laraparf@mail.ru

Received by the editorial office on 20.06.2026

Key words: *children with intellectual disabilities, sports and correctional activities, psychomotor development.*

Introduction. Motor activity with elements of sport is one of the most effective mechanisms for including people with intellectual disabilities in the system of social relations, forming their motor, cognitive, communicative and social qualities. The availability, variability of content and the possibility of long-term regular support of sports and specific programs determines their active introduction into the practice of adaptive physical education of children with intellectual disabilities, where special at-

tention is paid to integrative correction and development of indicators of the psychomotor and social sphere. At the same time, currently, in the practice of ROS, there is an insufficient development of comprehensive diagnostic tools that allow us to objectively assess the dynamics of psychomotor development and the level of social adaptation of persons with intellectual disabilities [1].

Objective of the study to substantiate a set of tests and develop differentiated scales for assessing the psychophysical development of children with intellectual disabilities in the process of sports and correctional activities.

Table 1-Indicators of psychomotor development

Cognitive processes	Characteristics of the psychomotor development indicator
Perception	Accuracy of differentiation of spatial, temporal, rhythmic parameters of movements and visual-motor and auditory-motor coordination.
Memory	Volume, correct memorization and reproduction of the sequence of motor actions, stability of motor skill
Attention	Stability, concentration, volume, distribution and switching of attention in the process of performing motor actions
Thinking	Analysis of the motor task, establishing cause-and-effect relationships, planning and variability of motor actions in changing conditions

Table 2-Scale of differentiated assessment of the level of psychomotor development

Level of psychomotor development	Total score	Qualitative characteristic
Low	0-16	Cognitive processes in motor activity are not sufficiently formed; constant teacher support is required
Below average	17-32	Processes are partially formed; motor tasks are performed with significant help
Average	33-48	Processes are formed satisfactorily; motor tasks are performed with little help
High	49-64	Processes are formed steadily; motor tasks are performed independently and consciously



Methods and structure of the study. The existing approaches to the assessment of psychomotor development indicators are summarized. Taking into account the specifics of the sport, a set of tests has been selected and tested. Differentiated assessment scales have been developed. The participants were people with disabilities (9-16 years old) who are engaged in floorball, mini-football, badminton, table tennis, rhythmic gymnastics, cross-country skiing, track and field athletics, and snowshoeing at the SOG.

Results of the study and discussion. Indicators of psychomotor development that reflect the degree of formation of cognitive processes (perception, memory, attention, thinking) that are manifested directly in motor activity are determined (Table 1).

For each sport, appropriate tasks were selected, taking into account its specifics. Each task is evaluated on a four-point scale. The test results (16 tasks) are summarized to determine the level of psychomotor development (maximum 64 points) (Table 2).

Four-level assessment system (0-16 / 17-32 / 33-48 / 49-64) is accompanied not only by a quantitative, but also by a qualitative characteristic, which is important for building an individual correction route for each student.

Conclusions. Thus, methods for evaluating the effectiveness of sports and correctional classes

for children with intellectual disabilities represent a scientific and methodological contribution to solving the problem of the lack of diagnostic tools in AFC, taking into account the specifics of sports disciplines. The prospect of further research is to expand the evaluation battery through social-communicative, emotional-volitional and neurophysiological indicators, which will allow us to move from a single-component (psychomotor) to a full-fledged bio-psycho-social model for evaluating the effectiveness of sports and correctional classes.

The work was carried out within the framework of the state task of the Ministry of Sports of the Russian Federation 777-00035-26-01 (registration number PTNI 1025031400153)

References

1. Parfenova L. A., Glazkova G. B., Gerasimov E. A. Otsenka effektivnosti sportivno-vidovogo podkhoda v fizicheskom vospitanii uchashchikh srednego shkolnogo vozrasta s otnosheniyami v sostoyanii zdorovya [Evaluation of the effectiveness of the sports-specific approach in the physical education of secondary school students with deviations in the state of health]. Sport. Medicine. - 2020. - Vol. 20, No. 2. - pp. 132-138.



Effectiveness of a powerchair football training methodology for individuals with musculoskeletal impairments

UDC 796/799

E.A. Gibulin

PhD, Associate Professor **L.A. Parfenova**¹

¹Volga Region State University of Physical Culture, Sports and Tourism, Kazan

Corresponding author: Zhenia.gibulin@yandex.ru

Received by the editorial office on 01.07.2026

Keywords: *powerchair football, musculoskeletal impairments, adaptive sport, coordination abilities, medical rehabilitation, social adaptation.*

Introduction. Adaptive sport is an important component of comprehensive rehabilitation and social integration for persons with disabilities. It is particularly relevant for individuals with the consequences of cervical spine and spinal cord injuries, in whom motor impairments are accompanied by spasticity, pain, and psycho-emotional disorders. The active involvement of persons with traumatic spinal cord injury in purposeful motor and game-based activities is considered appropriate [1]. A sport-specific approach, which involves the holistic mastery of an accessible sport, improves the consistency of training and its motivational appeal [2]. Powerchair football is a team sport accessible to individuals with severe motor impairments. However, Russian research provides insufficient evidence on the organization of the training process and the comprehensive evaluation of its effectiveness.

Objective of the study to develop and experimentally substantiate a powerchair football training methodology for individuals with musculoskeletal impairments.

Methods and structure of the study. The study was conducted from September 2025 to May 2026 with the Timer powerchair football team in Kazan. The sample included 15 men (mean age, 34.5 years) with consequences of traumatic cervical spinal cord injury at the C4-C7 levels. Training sessions were held three times per week for 120 minutes: two sessions at the Triumph Sports Complex and one session in the gym of M.N. Sadykov City Clinical Hospital No. 7. Sport-specific technical, clinical-functional, and psycho-emotional indicators were assessed.

Sport-specific performance was assessed using the completion time of the slalom ("Snake") test and ball dribbling between cones, the number of accurate passes completed in 60 seconds, and the accuracy of 10 shots on goal. Clinical-functional monitoring included the Rehabilitation Routing Scale (RRS), SCIM III, WST-Q Power Wheelchair, the Modified Ashworth Scale, the Visual Analogue Scale (VAS), Borg CR10, HADS, and WHOQOL-BREF.

Results of the study and discussion. The training methodology comprised four stages. The adaptation stage focused on developing motivation, mastering basic powerchair control skills, and strengthening the shoulder girdle muscles. The means used included general developmental exercises, basic mobility tasks, stops and turns, and psychological adaptation. The coordination and technical stage focused on spatial orientation, control accuracy, and the acquisition of technical skills. It included trajectory-control exercises, such as the slalom course and circling cones, as well as basic ball exercises, including dribbling, receiving, and stopping the ball. The technical and tactical stage was aimed at improving ball-control techniques and individual and group interactions. It included passing and receiving exercises, shots on goal, interceptions, blocking, and the simulation of game situations involving attack, defense, and transitions. The competition stage focused on team cohesion and tactical preparation through participation in matches and tournaments. Practice matches, analysis of competitive situations, and psycho-emotional support were used. The program combined individualized tasks, pair and group exercises, simulated game situations, and mandatory monitoring of physical and emotional status. The table presents the changes in the studied indicators reflecting the effectiveness of the rehabilitation and pedagogical intervention.



Indicator	Before the experiment $\bar{x} \pm \sigma$	After the experiment $\bar{x} \pm \sigma$	Change (%)
Slalom ("Snake") test, s	24,3 ± 3,8	18,6 ± 2,7	-23,5
Ball dribbling, s	31,7 ± 4,2	24,8 ± 3,9	-21,8
Accurate passes in 60 s	12,3 ± 2,1	19,4 ± 2,9	+58,3
Shot accuracy, %	41,5 ± 5,6	72,8 ± 7,6	+75,6
SCIM III, points	41,1 ± 5,2	47,5 ± 5,6	+15,6
WST-Q, %	53,9 ± 7,3	69,3 ± 7,7	+28,0
Spasticity (Modified Ashworth Scale), points	2,0 ± 0,8	1,6 ± 0,6	-20,0
Pain intensity (VAS), points	2,9 ± 0,8	2,0 ± 0,8	-31,0
Perceived exertion (Borg CR10)	5,9 ± 0,8	4,0 ± 0,8	-32,2

A reduction in anxiety and depressive symptoms according to HADS and an improvement in quality of life according to WHOQOL-BREF were also observed ($p < 0.05$). A strong correlation was identified between powerchair control skills and the number of passes ($r = 0.97$), indicating improved technical preparedness. Competitive performance was confirmed by the season results: 7 wins, 2 draws, and 3 losses in 12 matches; first place at the Republic of Tatarstan regional tournament; and third place at the Russian Championship in Sochi. Compared with the previous year, shot accuracy and the number of successful interceptions and blocked balls increased, while defensive errors decreased by 70%. Greater game initiative and improved team interaction were also observed.

Conclusions. The implementation of the developed powerchair football training methodology for individuals with musculoskeletal impairments resulted in significant improvements in coordination and

technical-tactical preparedness, functional independence, psycho-emotional status, and athletes' quality of life. Provided that medical indications and individual characteristics are carefully considered, the program may be recommended for use by powerchair football teams.

References

1. Bodrova, R.A., Zakamyrdina, A.D., Delyan, A.M., et al. Effectiveness of active medical rehabilitation technologies in Paralympic athletes participating in team sports. *Sportivnaya meditsina: nauka i praktika [Sports Medicine: Research and Practice]*. 2023; (1): 41-47.
2. Parfenova, L.A., Glazkova, G.B., Gerasimov, E.A. Evaluation of the effectiveness of a sport-specific approach in physical education of middle-school students with health impairments. *Chelovek. Sport. Meditsina [Human. Sport. Medicine]*. 2020; 20(2): 132-138.