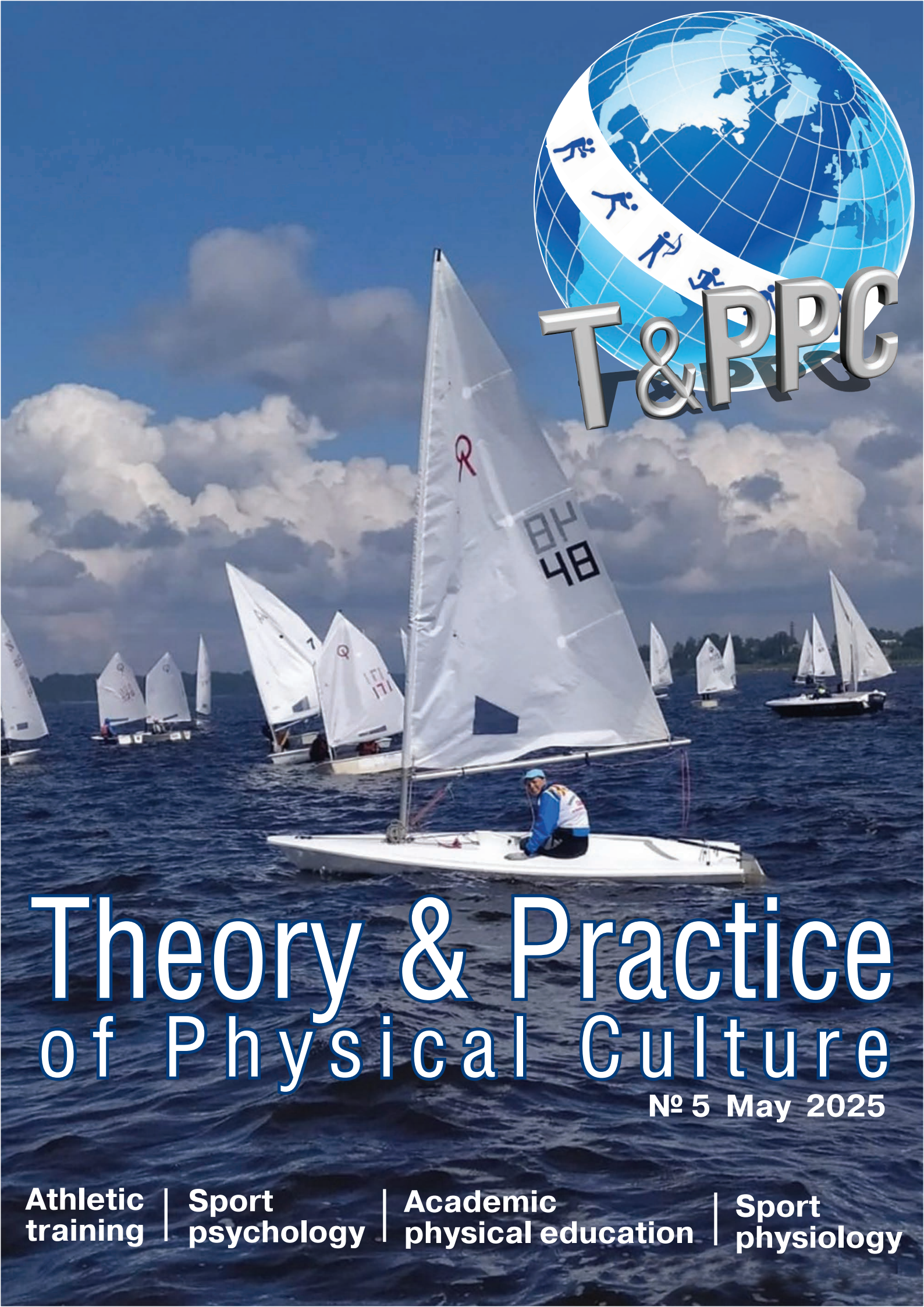

Theory & Practice of Physical Culture

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Athletic training | Sport psychology | Academic physical education | Sport physiology

The focus group method in sociological research on physical culture and sports

The relevance of using the method of focus groups or in-depth interviews in sociological research in the field of physical culture and sports is explained by the possibility of forming, broadcasting and exchanging opinions during the interaction of respondents on a selected topic. Due to the insignificant time spent on organizing and conducting a discussion within the framework of an in-depth interview, the researcher has the opportunity to quickly obtain information, which is important in the rapidly changing conditions of modern society.

The focus group is currently used both as an independent method and in combination with surveys and other research tools, which provides sociologists with the opportunity to obtain a significant amount of high-quality information that reveals various ways to solve the problem under study and confirm its relevance.

This method provides the necessary information structuring and allows in-depth substantiation of the importance of social projects in the field of physical culture and sports.

In the field of physical education and sports, the focus group method can be used to conduct research on socially important issues. Its distinctive feature from other methods is that, in addition to verbal data, the moderator can record a wide range of non-verbal reactions: facial expressions, gestures, poses, tone of speech, etc., which, when professionally interpreted, allow for more valuable information than, for example, in a regular interview.

The analysis of scientific research in the field of sports sociology, as well as our own experience, allows us to identify the following areas in which the focus group method can be effectively applied:

• attitude towards sports and physical activity: to identify the motivation of various groups of people to play sports or, conversely, to find out what is the barrier to starting or continuing classes; assessment of respondents' perception of various sports, sporting events, etc. identification of values that people have associated with sports, for example, health, socialization, achievement of goals, entertainment, etc.;

• development and evaluation of sports programs and products: identification of the needs of the target audience in the types of programs and services, for example, programs for the elderly, people with disabilities, etc.; feedback on sports goods and services under development (clothing, equipment, applications) in the early stages of release; evaluation of the effectiveness of existing programs, i.e. how well they meet the needs and expectations of users.

• research on consumer behavior of sports services: studying the factors of choosing a sports club, coach, sport, etc.; determining the loyalty of consumers of sports services; assessment of customer satisfaction with various aspects of sports services (training, equipment, staff, service, etc.).

• research on the social aspects of sports: analysis of the impact of sports on the health and well-being of the population; studying the problems of discrimination and inequality in sports; assessment of the role of sport in the formation of civic identity and social cohesion.

The focus group is an important methodological tool in sociological research of physical culture and sports, which allows to obtain a qualitative expert assessment of the attitudes and points of view of respondents in relation to the studied problems. The specifics of using in-depth interviews in the sports field are the need to take into account the specifics of the target audience (athletes, coaches, fans, people leading an active lifestyle, etc.) and adapt the focus group scenario to their interests and experience. The results obtained through focus groups can be used to develop effective programs to promote projects in the field of physical culture and sports, improve sports infrastructure, as well as to identify and solve problems faced by participants in sports activities. Further research in this area may be aimed at studying the effectiveness of various approaches to conducting focus groups in the field of physical culture and sports, as well as at developing specialized methods for analyzing the data obtained.

We invite scientists to publish the results of scientific research aimed at finding and studying the value meanings of physical culture and sports.

Editor-in-Chief of TPPC, Honored Worker of Physical Culture of the Russian Federation
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Theory and Practice of Physical Culture

Contents

A comparative examination of the allocation of training burdens for elite mogul skiers throughout the year

UDC 796.926.613

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Abstract

Objective of the study was to comparative examination of the allocation of training burdens for elite mogul skiers throughout the year, using data from 2021 to 2024.

Methods and structure of the study. The workload of 12 top-tier Russian mogul skiers was determined through the examination of their training logs.

Results and conclusions. The disparities in the metrics that describe the overall training loads in the Olympic and non-Olympic annual training cycles have been identified, and the peculiarities of the load distribution in the preparatory and competitive phases have been emphasized. The values of the loads outlined in the federal standard for sports training in freestyle significantly surpass the actual number of training sessions and time. It was discovered that the training sessions in the preparatory phase are longer in duration, while in the competitive phase they are shorter but more frequent. The Olympic annual cycle is characterized by a higher volume of specialized loads. The findings of this research can be regarded as contemporary models for periodization in the sports training of elite mogul skiers.

Keywords: *mogul, freestyle, load planning, periodization, annual training cycle, highly qualified athletes.*

Introduction. Mogul and dual mogul are Olympic freestyle sports. Mogul is characterized by complex coordination techniques of movements that mogul skiers demonstrate during a high-speed descent along a hilly ski slope and performing acrobatic tricks from ski jumps [2]. In each sport, when working with highly qualified athletes, specialists pay special attention to planning training loads, taking them into account and analyzing them in the annual training cycle. This approach, subsequently recognized by scientists around the world as “classical”, was first scientifically substantiated by L.P. Matveyev [3], which then began to be actively used by scientists in various sports [1, 4]. The result of this extensive scientific work was the substantiation of alternative models of periodization, distribution and ratio of loads based on the specifics of a particular sport. To date, scientists have identified and characterized models of periodization of training loads in biathlon and cross-country skiing [5], but similar studies in freestyle, in general, and in moguls, in particular, have not yet been conducted, which complicates the planning of pedagogical influences in the annual training cycle and does not allow us to answer the question that is important for high-performance sports: is there a difference in the volume of training of highly qualified moguls in the Olympic and non-Olympic seasons?

Objective of the study was to comparative examination of the allocation of training burdens for elite mogul skiers throughout the year, using data from 2021 to 2024.

Methods and structure of the study. The following methods were used in the work: theoretical analysis of scientific and methodological literature and documents, modeling, statistical processing of the research results.

During the study, the distribution of training loads of Russian highly qualified mogul skiers, members

of the Russian freestyle skiing team and participants in the XXIV Olympic Winter Games in 2022 in Beijing (PRC) was monitored. Based on the results of the preliminary study, we selected 12 electronic diaries that were filled out by athletes daily in the period from 2021 to 2024. Information was collected in the process of scientific and methodological support for sports training. Loads were monitored in the conditions of centralized and home training. Control over filling out sports diaries by mogul skiers was carried out by members of the integrated scientific group.

When calculating the time for physical training of mogul skiers based on the data of the Federal Standard of Training in the sport of «freestyle» (hereinafter – FSST), the percentage of general and special physical training was combined. At the same time, due to the impossibility of accurately determining the time for tactical training from the latest edition of the standard, we used only data on the time of technical training[1].

Modeling was used in the distribution of monthly volumes of loads of various types of highly qualified mogul skiers.

The check for compliance with the normal distribution law was performed using the Shapiro-Wilkie criterion. Since in our case the obtained results had an abnormal distribution, the reliability of the differences between samples was determined using the Mann-Whitney criterion.

[1] Prikaz Ministerstva sporta RF № 876 ot 31.10.2022 g. «Ob utverzhdenii federalnogo standarta sportivnoy podgotovki po vidu sporta «fristayl» (zaregistrirovano v Minyuste Rossii 5.12.2022 № 71346). [Electronic resource]. Available at: https://base.garant.ru/405875915/ (date of access: 24.02.2024).

Results of the study and discussion. It was established that the Olympic annual cycle (hereinafter referred to as OAC) differed to a greater extent from the non-Olympic cycle (hereinafter referred to as NAC) in the number of training days (241 and 200 days), classes (556 and 424 classes), total training time (1030:38 and 830:19 h:min) and time for technical and tactical training (506:05 and 339:01 h:min) ($p<0,01$) (see Table 1). The analysis of the ratio of loads in the preparatory (hereinafter referred to as PP) and competitive periods (hereinafter referred to as CP) of the OAC showed that mogul athletes in the PP had fewer training days and sessions compared to the CP, but the training time spent on physical and technical-tactical training was greater than in the CP. This fact is explained by the longer duration of training sessions in the PP and shorter (but more frequent) - in the CP ($p < 0,01$). The study of the distribution of loads of the same NAC indicators showed that all load parameters in the PP exceeded similar characteristics in the CP. Comparing the total volumes of loads of the OAC and NAC with similar characteristics of the FSST, we note that the standard data on the volume of training sessions and time significantly exceeded the actual ones (Table 1).

Comparison of the total volumes of loads (Table 2) showed that the NAC had significantly higher volumes of speed-strength and coordination training, and the OAC had significantly higher volumes of aerobic training, while the volumes of strength training in the OAC and NAC were comparable ($p<0,05$). Studying the characteristics of the distribution of

Table 1. General characteristics of the distribution of training loads of highly qualified mogul skiers in the annual training cycle

Indicators	OAC, M±m				NAC, M±m				p_{2-6}	FSST
	AC	PP	CP	p_{3-4}	AC	PP	CP	p_{7-8}		
1	2	3	4	5	6	7	8	9	10	11
Training days, number	241±10,21	94±5,13	147±5,2	**	200±13,5	108±15,7	92±2,28	-	**	нет данных
Training sessions, number	556±39,5	196±6,4	360±33,05	**	424±18,18	220±11,90	204±8,26	*	**	624-832
Training time, h:min	1030:38±6,11	615:38±9,45	415:00±5,03	**	830:19±11,70	499:10±11,7	331:09±7,29	**	**	1248-1664
Time on FP, h:min	524:33±14,84	327:53±12,50	196:40±3	**	491:18±21,85	269±22,21	222±5,74	**	-	437-832
Time on TTP, h:min	506:05±9,5	287:45±4,4	218:20±8	**	339:01±10,3	230±9,8	109±9,7	**	**	374-832

*Note: OAC – Olympic annual cycle in the 2021-2022 season; NAC – non-Olympic annual cycle (based on average values of the 2022-2023 and 2023-2024 seasons); TC – total volume of loads in the annual cycle; PP – preparatory period; CP – competitive period, FSST – Federal Standard of Sports Training in the sport of freestyle in the latest edition; * – differences are significant at the level of p≤0.05; ** – differences are significant at the level of p≤0.01; – – differences are significant at the level of p>0.05.*

Table 2. The ratio of training loads developing various physical qualities and abilities of highly qualified mogul athletes in the annual training cycle

Indicators	OAC, M±m				NAC, M±m				p_{2-6}
	AC	PP	CP	p_{3-4}	AC	PP	CP	p_{7-8}	
1	2	3	4	5	6	7	8	9	10
Volume of speed-strength training, hr:min	12:25±0,58	11:45±0,58	0:40±0,58	**	16:05±3,31	14:18±3,20	2:37±0,75	**	*
Volume of strength training, hr:min	165:03±12,49	119:43±18	45:20±7,23	**	164:14±7,88	106:55±6,44	55:19 ±4,46	**	*
Volume of general training and flexibility means, hr:min	123:25±9,71	71:20±10,54	52:05±3,1	**	122:17±7,3	68:13±7,3	54:05±1,6	**	-
Volume of coordination training, hr:min	42:59±7,21	22:43±5,57	20:16±3	-	57:37±8,36	37:37±6,5	20:00±4,18	**	*
Volume of aerobic training, hr:min	174:51±6,66	128:29±10,26	46:22±3,51	**	118:31±11,13	73:19±7,92	45:11±3,54	**	**

Table 3. Distribution of training loads of technical, tactical and special orientation of highly qualified mogul skiers in the annual training cycle

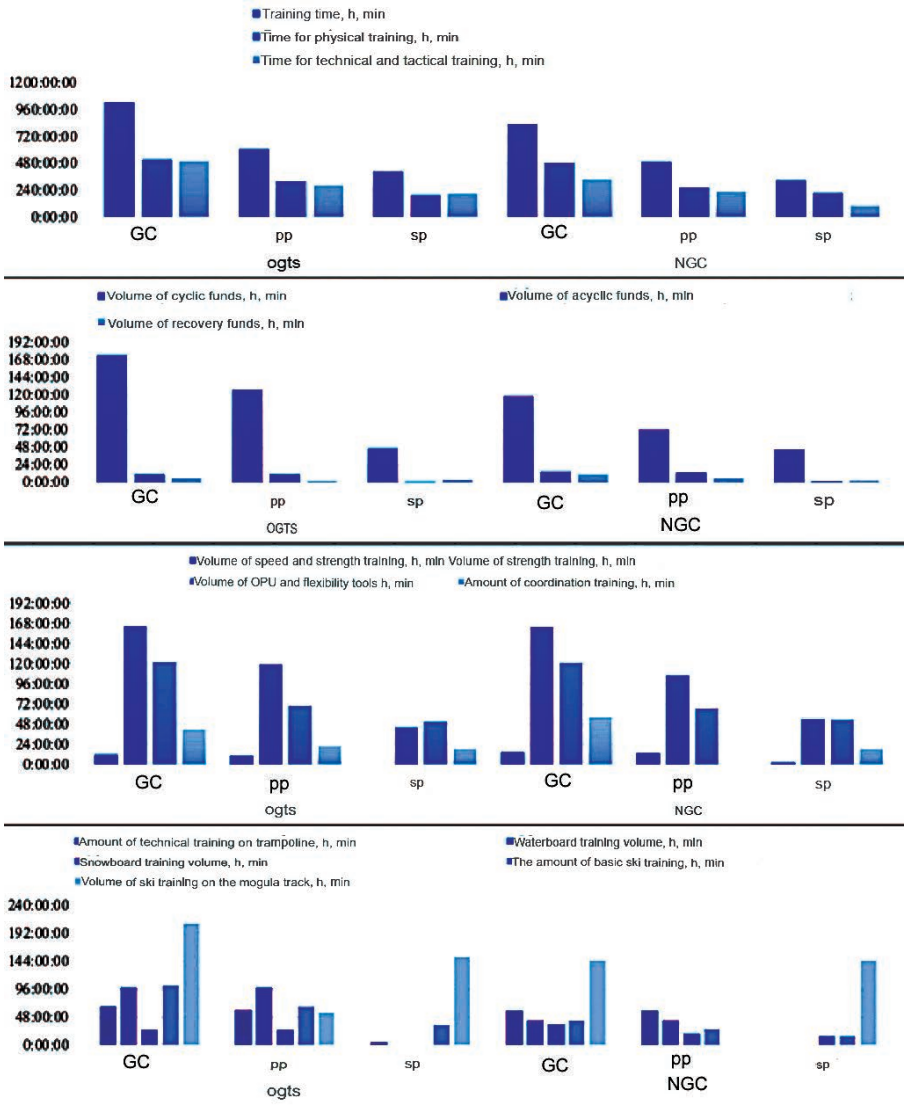
Indicators	OAC, M±m				NAC, M±m				p_{2-6}
	AC	PP	CP	p_{3-4}	AC	PP	CP	p_{7-8}	
1	2	3	4	5	6	7	8	9	10
Volume of TP on trampoline, hr:min	67:25±5,13	61:55±4,58	5:20±0,5	**	59:17±7,56	59:17±7,56	0	**	-
Volume of training on water ski jump, hr:min	100:40±14,15	100:40±14,15	0	**	42:33±6,71	42:33±6,71	0	**	**
Volume of training on snow ski jump, hr:min	27:15±6,03	27:15±6,03	0	**	37:40±5,58	21:16±3,83	16:23±2,25	*	*
Volume of basic ski training, hr:min	102:45±6,56	67:30±7,09	35:15±2,08	**	43:37±7,9	27:37±5,96	16:00±2,81	**	**
Volume of alpine ski training on mogul track, hr:min	210:00±9,54	56:40±6	153:20±3,61	**	147:10±8,50	0	147:10±8,50	**	**

loads by periods of the OAC, it should be noted that the volumes of pedagogical influences in the PP were significantly higher than in the CP ($p<0,01$). The same trend was observed in all indicators of the NAC load ($p<0,01$).

Table 3 shows the distribution features of special loads of mogul skiers in the OAC and NAC. Comparison of the total volumes of loads showed that greater priority in the OAC is given to training on the water ski jump (100:40 h:min), basic skiing (102:45 h:min) and alpine skiing (210:00 h:min) ($p<0.05$). Analysis of the ratio of loads between the periods of the OAC showed that in the PP, technical training on the trampoline, on the water and snow ski jumps, as well as basic skiing, significantly prevails, while the CP is characterized by a higher volume of special alpine skiing training ($p<0,01$). This trend in the ratio of loads between the PP and CP is also observed in the NAC ($p<0.01$).

The figure shows the models of periodization of the most significant types of loads for highly qualified mogul athletes in the OAC and NAC according to the parameters of the total volume for the annual cycle, as well as with the distribution of the values of pedagogical influences in the PP and CP. The presented data can be used by coaches and specialists as guidelines when constructing an annual training cycle for mogul athletes at the stage of higher sports mastery, but taking into account the available training and competitive conditions and opportunities.

Conclusions. The OAC is characterized by a large volume of training loads in general, as well as a more significant concentration of special loads. At the same time, the actual volume of training time for mogul athletes is significantly less than stated in the standard. The data obtained as a result of the study can be used as a modern periodization of training loads in the annual training cycle of elite mogul athletes.



Models of periodization of some types of loads of highly qualified mogul skiers in the annual training cycle

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The variability of the effect of pre-start warm-up on the activation of a swimmer's competitive performance

UDC 797.21

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Abstract

Objective of the study was to assess the efficacy of different warm-up techniques employed by swimmers in enhancing their athletic abilities.

Methods and structure of the study. After examining the available literature in the Scopus and RSCI databases, a retrospective analysis was conducted on the approaches, content, and methodological frameworks for pre-swim warm-up in swimming, with a focus on the evolution of theory and methods in sports training.

Results and conclusions. It was discovered that the ideal pre-swim warm-up for a swimmer involves a moderate initial activity of swimming at a distance of 1000 meters at a speed of 60-80% of their maximum oxygen consumption. To optimize performance in the short term, it is more beneficial to take a short rest period of 3-10 minutes. In this context, a longer or more intense warm-up can lead to an excessive activation of energy systems, potentially triggering various biomechanical and physiological responses, which can be both beneficial and detrimental, depending on the demands of the competition.

Keywords: *swimmer's warm-up, preliminary activation of the functional state, physiological reactions of athletes.*

Introduction. Athletes and coaches systematically improve approaches to improving the content of warm-up, which contributes to the improvement of sports results. In particular, a 5-10-minute active warm-up of moderate intensity can significantly improve short-term results in solving a number of sports problems. The launch of cardiovascular and neuromuscular processes under the influence of an active warm-up occurs with a delayed effect after 3-5 minutes, which lasts for 5-10 minutes after its completion [2].

Although a high-intensity warm-up can cause a state of acute fatigue, it is significantly reduced during the first few minutes of recovery, providing an opportunity to extract the ergogenic benefit of the improved state. This effect is defined in the literature as activation of performance, which should be considered as one of the tasks of the warm-up [3]. Research has shown that warming up in water has a positive effect on swimmers' performance, especially in events longer than 200 m. It is recommended that swimmers' warm-ups should be conducted over a distance of 1000 to 1500 m and include short, specific exercises at an intensity similar to that of the competition. It is important to allow sufficient rest time after the warm-up to avoid early fatigue and ensure restoration of energy reserves (15-20 minutes) [10]. In addition to exercises performed in water, a large number of studies have been published in recent years examining alternative warm-up methods, with a growing trend towards using exercises on land and various combinations with other means [4].

Objective of the study was to assess the efficacy of different warm-up techniques employed by swimmers in enhancing their athletic abilities.

Methods and structure of the study. A retrospective analysis of approaches, content and methodological algorithms of pre-start warm-up of swimmers, associated with the development of the theory and methodology of sports training in swimming, was conducted. The instrumental basis of the work included a

review of literary data in the international Scopus and RSCI databases in accordance with the main stages of review studies. These include: preliminary formulation of the research question; compilation of a research bank on the topic; selection of the most relevant studies within the topic; compilation of a structured data portfolio; comparison, generalization, formulation of conclusions.

The criteria for selecting a source for inclusion in the data bank were: the study was controlled according to the «before-after» scheme; the participants in the study were qualified swimmers over 13 years old; studies assessing the urgent reaction of swimmers to the warm-up immediately before the start; the content of the warm-up included exercises on land and in water in relation to a specific exercise of the competitive program. The effectiveness of warm-up exercises was assessed based on traditional factors influencing subsequent performance, including the type, duration and intensity of the warm-up. The assessment was based on the dynamics of kinematic parameters (time, distance, speed, length and stroke rate); kinetic parameters (strength, power); physiological parameters (lactate level, temperature, heart rate, oxygen saturation, hemoglobin concentration). In this study, swimming time parameters were used as the primary outcome reflecting the response to the warm-up.

Results of the study and discussion. When comparing the results of competitions with a warm-up in the water without physical activity before the start, despite the different observed reactions of swimmers, it can be concluded that the inclusion of a warm-up in the water before 50-100 m swims can lead to improved results compared to no warm-up, if the intensity of the warm-up is sufficient and the necessary rest time is provided between the warm-up and the start. Studies by various authors have not found any differences in the results in 100 m freestyle swimming when conducting a 20- and 10-minute warm-up at HRmax 60%, which suggests that 10 minutes of activity is enough to trigger the physiological mechanisms of activation, and the chosen intensity is not high enough to cause fatigue after a longer warm-up [5].

When comparing a standard 1200 m warm-up with shorter (600 m) and longer (1800 m) warm-ups, no difference was found between the short and standard warm-ups (15-20 min), while the 100 m swim performance was 1,46% and 1,34% faster, respectively, compared with the long warm-up (30 min). Swimmers achieved the lowest blood lactate concentration ([La−]) after the long warm-up due to stimulation of the buffering capacity by prolonged low-intensity exercise [8].

Thus, a certain duration of warm-up is required in swimming; however, prolonged warm-ups increase the dependence on aerobic systems, which is counterproductive in sprint swimming competitions, in which anaerobic metabolism is a significant source of energy. In a study of the effects of a warm-up including 400 m swimming, high-speed starts over a distance of 2 × 15 m, followed by a variety of: a) 3 × 3 squats with a load of 27 to 68 kg; b) 3 × 3 sets of jumps with a weight of 15% of body weight; c) jumps from a 1 m springboard 2 × 5 times [11], it was found that the start time for 15 m improves only after squats with weights, which can be a simple way to stimulate the lower limbs in urgent preparation for the start [1]. When planning the intensity of the warm-up, the characteristics of the physiological reactions of athletes should be taken into account [7]. Due to the large volume of low-intensity training, swimmers may have an increased proportion of slow fibers that respond poorly to high-intensity stimuli. In this case, the inclusion of low-intensity exercises with an increase from moderate to high during the warm-up is intended to elicit a positive response from swimmers.

In studying the effects of warm-up in water, including elements of external load, various equipment and gear were used. Warm-up in water with a volume of 1000-1200 m with the development of maximum efforts when swimming in 8x12.5 m series paddles and subsequent 2-6-minute rest leads to a decrease in maximum traction efforts and force impulse, which is a consequence of the development of excessive fatigue and insufficient rest interval. On the other hand, an increase in rest time will lead to the athletes' body leaving the state of greatest activity [6]. After swimming on a tether 3×10 with a series of strokes with one arm followed by an 8-minute rest, a deterioration in the competitive result in 50 m swimming and stroke length is observed, which may be associated with changes in the kinematics of swimming, body position, and arm movement trajectory compared to real swimming [9]. Distorted biomechanical parameters do not correspond to real swimming conditions, which cannot have a positive effect on athletic performance.

Conclusions. Although there is great variability in athletes' responses to the warm-up, it appears that the warm-up involves moderate activity (1000 m at 60-80% VO_{2max}). For maximal swimming performance

in the short term, an optimal recovery period (3-10 min) is more beneficial. Therefore, a longer or more intense warm-up may over-activate energy systems, potentially generating different biomechanical and physiological responses that may be beneficial or detrimental depending on the demands of the competitive activity.

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A comparative examination of instructional methods in team and solo sports

UDC 796.08

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Abstract

Objective of the study was to discern the distinctive aspects of training in team and individual sports.

Methods and structure of the study. To accomplish this objective, a combination of quantitative and qualitative analytical techniques and statistical analysis was employed. The research was conducted in a series of steps: data gathering and processing, summarizing the findings, and drawing conclusions.

Results and conclusions. Several key differences in approaches to training athletes in team and individual disciplines have been identified. Mainly, team sports require an emphasis on tactical training and player interaction, while individual disciplines are focused on developing the technique of performing a specific element and managing the athlete's psycho-emotional state.

Keywords: *analysis, comparative analysis, sports, team sports, individual sports, training methods.*

Introduction. In general, individual sports are aimed at developing the physical and mental qualities of an athlete. The main object of the training process in this case is, as a rule, the athlete himself, and in the process of his training it is necessary to take into account his qualitative features as fully as possible. Team sports require an athlete to regularly demonstrate those qualities that are much more difficult to develop in an individual sport. The ability to act in a team, to fulfill the requirements and tasks that are set for them during competitions depends not only on the athlete himself, but also on the multiple coordination of actions in the team and the correct distribution of roles. There are some differences in approaches to preparation and in the importance of certain training and competition modes. And these differences must be taken into account when conducting training. For example, in individual sports such differences begin to appear during training, and in team sports they become obvious even at the stage of pre-competition preparation.

Objective of the study was to discern the distinctive aspects of training in team and individual sports.

Methods and structure of the study. The following psychodiagnostic methods were tested in the study:

- N. Hall's test for the level of emotional intelligence;
- D. Guilford's method for diagnosing social intelligence.

The study sample consisted of 161 athletes, of which 100 represented team sports, 61 - individual.

Results of the study and discussion. This study identified several key differences in approaches to training team and individual athletes.

First, let us look at the results in the sample of athletes involved in team sports.

The successful performance of athletes largely depends on their emotional stability. Experts identify three key determinants of emotional stability. The first of these is emotion management, which was recognized as the most important component of emotional intelligence with a regression coefficient of = 0,560 and a significance level of p = 0,000. The second de-

terminant is the process of emotion recognition, which has a regression coefficient of β = 0,379 and a significance level of p = 0,019. The third determinant includes self-confidence and adequate modeling of the situation, which also significantly correlate with competitive stability.

Competitive motivation depends on internal drive and the degree of autonomy. These two components have equal weight in the general motivation model (R^2=0,545), but differ in the strength of their influence: self-motivation has a significance level of p=0,09, and autonomy significantly influences motivation with p=0,010.

Uncontrolled uncertainty reduces sensitivity to stressors, while emotional regulation (R^2=0,671) plays an important role in reducing reactivity, demonstrating a coefficient β=-0,5 and a significance level of p=0,01. Modeling and adaptability also correlate well with emotional stability.

Sensitivity to personally significant stressors (R^2=0,507) is reduced by emotional control (emotional intelligence) with a coefficient β of -0,3 and self-confidence (coefficient β of -0,4).

Neuropsychic stability (R^2=0,613) is also closely related to emotional management and constant internal self-organization. Important predictors of effective stability are also the ability to plan and model one's actions. In athletes specializing in individual sports, mental stability is increased by the general level of emotional intelligence, regulatory independence, modeling and self-esteem indicators.

Emotional Intelligence and Modeling. Competitive emotional stability (parameter Y^2=0,434) is determined by a pair of key variables: «emotional intelligence» with the coefficient β=0,7 (p=0,01) and «modeling» (β=0,4, p=0,01). In terms of reliability, the tolerances of these parameters are 0,7 and 0,9, respectively. This is confirmed by the inverse relationship revealed in the subgroup of the «Expression Groups» (IG) test (β=-0,5, p=0,08, reliability 0,7).

Competitive motivation (Y^2=0,396) is determined by «independence» (β=-0,6, p<0,001). That is, the higher the independence, the lower the motivational activity of athletes. The «health» parameter (HP) has β=-0,4, p=0,06 and a confidence interval of 0,09, which may indicate instability of the relationship in the overall model.

Neuromedical stability. «Neuromedical stability» demonstrates the highest predictive characteristics in the form of the parameter Y^2=0,643. The level of emotional intelligence as the main negative predictor has a standard coefficient of β=-0,7 (p<0,001). The degree of modeling control (DC) is represented by β=-0,4, p=0,02. The parameter «technical preparation» (RAS): β=0,3, p=0,06 and «differentiation of self-assessment» (β=0,2, p=0,01) have a positive effect. Reliable acceptable values of variables from 0,09 to 0,9.

Thus, team sports require strategic thinking, which is based on interaction and mutual understanding between athletes. Therefore, during training, coaches must organize not only the application of individual skills, but also form a team spirit, which ensures effective interaction between team members. Team thinking developed during the training process helps athletes adapt to changes during competitions, which is necessary to achieve the best results.

In individual sports, the emphasis is on the personal responsibility of athletes for the result and continuous self-improvement. Here, coaching training is more specialized and often includes elements aimed at physical, technical and psychological preparation of an athlete to achieve his personal goals and increase motivation for training.

Conclusions. The results of the conducted analysis show that a combined approach to the training process, which takes into account both individual and team aspects, can significantly increase its effectiveness. For example, the introduction of team game elements into individual sports can strengthen the team spirit of an athlete and increase his level of motivation, and the use of an individualized approach in "team players" helps to reveal their personal individuality and develop unique qualities. It is also necessary to take into account the specifics of personal and team sports and the individual characteristics of each athlete to increase the return on the training process. A harmonious combination of various training methods adapted to the training conditions and scalability of small and large functionality leads to the maximization of the results of achieving the final goal in the process of sports activities. A fine balance in the choice of training methods, which takes into account the specifics of the team's activities as a group, as well as the personal characteristics of each participant in the training process, is the basis for the successful implementation of coaching plans. Thus, the research results show that personal resources play a unique role in

enhancing psychological resilience and overcoming stressful situations among athletes in team and individual disciplines.

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Evaluation of the force field rotor in highly skilled martial artists when moving using the shuttle method

UDC 796.8

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Abstract

Objective of the study was to identify the characteristics of the rotational force field in which the center of mass of athletes shifts during shuttle-like movements.

Methods and structure of the study. It is assumed that the athlete's center of gravity moves in a force field $\vec{F}$, created by the athlete and gravity. For the study, the shuttle method of movement was used. The demonstration of movement was carried out by two athletes qualified as a master of sports in jiu-jitsu.

Results and conclusions. The rotor of the force field, which is the athlete's center of gravity during the shuttle movement, is not fixed in time. For different athletes, the rotor's change from the coordinate can be either identical or opposite. Consequently, we can discuss a range of biomechanical parameters and characteristics that correspond to the correct technique, and we can also talk about various versions of the correct technique for executing the movement. A technical error refers to an action that prevents the subsequent motor task from being completed or involves an unnecessary expenditure of energy.

Keywords: *biomechanics of martial arts, jiu-jitsu, shuttle movement.*

Introduction. Bibliometric analysis of publications shows that scientific research on martial arts constitutes only a small share of all scientific information available in the field of sports sciences. A clear shortage is also felt in research on the biomechanics of technical and tactical actions.

Objective of the study was to identify the characteristics of the rotational force field in which the center of mass of athletes shifts during shuttle-like movements.

Methods and structure of the study. It was suggested that the center of gravity of each athlete is located in the force field $\vec{F}$, created by the athlete's efforts.

Research objectives:

- to plot the trajectory of the center of gravity of each athlete during movement;

- to calculate the rotor of the force field of each athlete;

- to evaluate the features of the twisting of the force field during movement in the shuttle method for highly qualified athletes.

The rotor of the force field is a value characterizing the degree of twisting of the force field:

$$rot \times \vec{F} = \left(\frac{dF_z}{dy} - \frac{dF_y}{dz}\right)\overrightarrow{e_x} + \left(\frac{dF_x}{dz} - \frac{dF_z}{dx}\right)\overrightarrow{e_y} + \left(\frac{dF_y}{dx} - \frac{dF_x}{dy}\right)\overrightarrow{e_z} \quad (1)$$

The first term characterizes the rotation around the O_x axis, the second around the O_y axis, and the third around the O_z axis. Since the experiment considered a two-dimensional image, the formula contains only one term, which describes the rotation around the O_z axis, perpendicular to the plane of the drawing:

$$rot \times \vec{F} = \left(\frac{dF_y}{dx} - \frac{dF_x}{dy}\right)\overrightarrow{e_z} \quad (2)$$

The study was conducted using the «shuttle» movement method. The movement was demonstrated by two athletes with the qualification of master of sports in jiu-jitsu. The mass of one athlete (№ 1) was 52 kg,

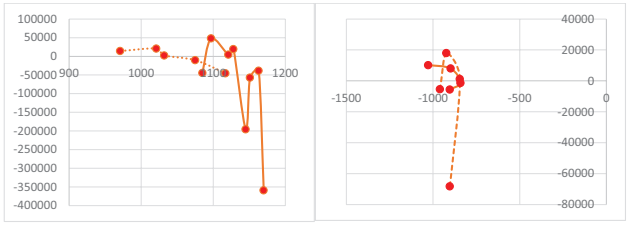
the second (№ 2) 85 kg. This difference was taken in order to more clearly demonstrate the differences and similar elements in the exercise performed by two qualified athletes. A similar selection of subjects was used in the experiment described in the article «Divergence of the force field during the process of movement using the «Shuttle» method, published in № 1 for 2025». Cyclograms with a time interval of 0.04 seconds were cut out from video recordings of movement using the «shuttle» method. The centers of gravity of each body segment were marked on them, the trajectory of the center of gravity of each of the athletes was constructed. Then, an estimate of the displacements of the center of gravity between the cyclograms relative to the coordinate axes was calculated. The projections of the velocities and accelerations of the centers of gravity were determined. The force acting on the athlete's center of gravity was determined using Newton's second law. The change in force was determined as the difference in force values between two adjacent cyclograms. The final formula for calculating the rotor value was:

$$rot \times \vec{F} = \left(\frac{F_{yi} - F_{y(i-1)}}{x_i - x_{i-1}} - \frac{F_{xi} - F_{x(i-1)}}{y_i - y_{i-1}}\right) \quad (3)$$

where F_{yi} - $F_{y(i-1)}$ is the difference in the projections of the values of the force acting on the center of gravity between two adjacent cyclograms onto the ordinate axis, x_i - $x_{(i-1)}$ – is the difference in the values of the coordinates along the O_x axis between two adjacent cyclograms, F_{xi} - $F_{x(i-1)}$ – is the difference in the projections of the values of the force acting on the center of gravity between two adjacent cyclograms onto the abscissa axis, y - $y_{(i-1)}$ – is the difference in the values of the coordinates along the O_y axis between two adjacent cyclograms.

Figure 1 shows the change in rot × $\vec{F}$, depending on the x coordinate during forward movement.

The enormous values of the force field rotor are striking. For athlete № 1, the field twist varies from -359125 Н/м to 127968 Н/м. For athlete № 2 from -68209 Н/м to -18069 Н/м. Apparently, this is a consequence of the fact that the athlete's body was considered a material point identified with the athlete's center of gravity when calculating the rotor. In reality, a significant part of the athlete's mass was supported by the tatami and the mass transferred by muscular effort was significantly less. Therefore, it seems erroneous to draw conclusions based on a comparison of digital indicators. However, it is possible to analyze the mechanical structure of oscillations.



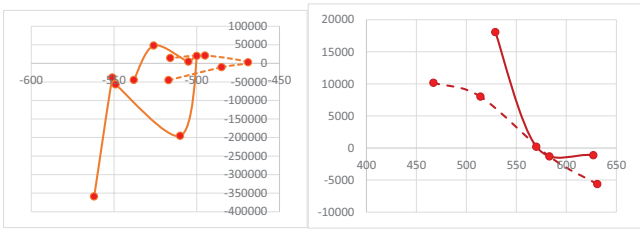
a) b)

Figure 1. Change rot × $\vec{F}$, depending on the x coordinate in the process of forward movements of athletes of the Master of Sports qualification in jiu-jitsu (solid line – first movement, dotted line – second movement, dashed-dotted line – third)

It is evident from figure 1 that the changes in the rotor of the force field have a structure close to oscillatory. In the process of forward movements, the rotor, depending on the x coordinate, can have both minimums and maximums, that is, we can talk about a different character of the field twist from movement to movement. At the same time, one cannot help but note a significant difference in the steepness of the graphs.

Apparently, it is possible to assume the existence of a certain region of permissible values of the rotor of the force field (quasi-attractors) [1-3] in which the center of gravity of the athletes moves. In addition, it seems more likely that there are several shuttle-type movement techniques, each of which has a right to exist.

Figure 2 shows the dependence of the rotor on the Y coordinates for two athletes.



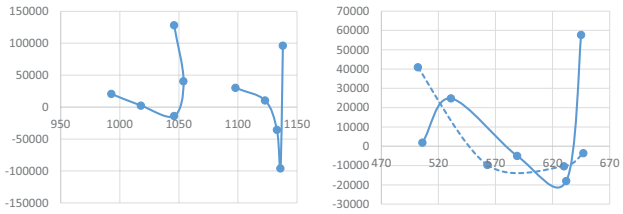
a) b)

Figure 2. Dependence of the twist of the force field on the Y coordinate during forward movements. a) athlete 1, b) athlete 2

Solid line – first movement, dotted line – second movement

In figure 2, one can observe the absence of twisting at the top point of the movement or its smallest value.

Figure 3 shows the values of *rot* × $\vec{F}$, depending on the x coordinate for backward movements of the center of gravity.

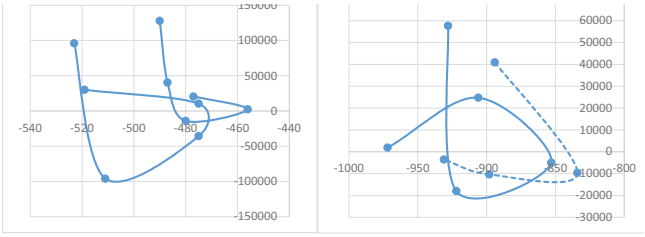


a) b)

Figure 3. The rotor of the force field in which the center of gravity of the athletes moves when moving backwards. a) athlete 1, b) athlete 2

Solid line – first movement, dotted line – second

It is evident from figure 3 that the general nature of the change in the rotor trajectory during the backward movement is preserved for both athletes. We can confidently speak of a minimum of twisting in each trajectory. Figure 4 shows the change in the rotor depending on the coordinate along the ordinate axis during the backward movement.



a) b)

Figure 4. The rotor of the force field in which the center of gravity of the athletes moves when moving backwards depending on the Y coordinate.

a) athlete 1, b) athlete 2

Solid line – first movement, dotted line – second, dash-dotted line – third

We can talk about the minimal twisting of the force field at the upper points of the trajectories for both athletes.

Conclusions. The rotor of the force field, in which the athlete's center of gravity moves during the shuttle movement, is not stationary in time. For different athletes, the change in the rotor from the coordinate can be either the same or the opposite. Therefore, we can talk about a variety of values of biomechanical parameters and characteristics corresponding to the correct technique, and we can also talk about several options for the correct technique for performing movement. A technical error will be understood as an action that makes it impossible to perform a subsequent motor task or that entails an unjustified expenditure of energy.

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Current trends in scientific research of sports training in freestyle

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Abstract

Objective of the study was to analysis of current trends in the field of scientific research on freestyle training.

Methods and structure of the study. The research employed a combination of theoretical analysis of literary sources and data categorization. The PubMed and Research Gate databases were utilized to gather and examine scientific material.

Results and conclusions. It has been confirmed that the current research in freestyle acrobatics is centered around the development of innovative systems for monitoring the physical fitness of elite athletes. These systems take into account specific fitness indicators, their relative importance, and a scale of reference values. The use of this model has allowed us to create a model for elite athletes.

Another significant area of research is the use of computer modeling, which has revealed that the main limitation in the twisting technique of acrobats is the increased frontal moment of inertia of the body due to the use of sports equipment.

Sports biomechanics focuses on the analysis of the phase structure of competitive exercise techniques in acrobatics.

The importance of incorporating exercises that target the core stabilizer muscles, which enhance the landing kinetics of freestyle skiers, is emphasized.

The moguls emphasize the significance of developing explosive power among elite moguls.. In certain freestyle disciplines, it is crucial to consider the impact of landing on the muscles of athletes. The findings presented here can be valuable for coaches and professionals in enhancing the training of freestyle skiers.

Keywords: *review, modern trends, sports training, freestyle, acrobatics, mogul, freeski.*

Introduction. Freestyle is one of the youngest Olympic skiing sports, which has been actively developing in the last few decades. However, unfortunately, there has been relatively little fundamental research in most freestyle sports disciplines. Nevertheless, the existing knowledge about the sports training of freestyle skiers requires periodic generalization, systematization and comprehension in order to establish key trends in scientific research in this area, taking into account which allows increasing the effectiveness of the training process [6, 7].

Objective of the study was to identification of modern trends in scientific research into sports training in freestyle based on the analysis of scientific and methodological literature and systematization of the obtained data.

Methods and structure of the study. The work used the method of theoretical analysis of scientific and methodological literature. To study and collect scientific material, the generally accepted Pub Med and Research Gate databases were used. We studied scientific publications on the research topic for the period from 1999 to 2024. The obtained information was systematized. In total, more than 30 publications on freestyle and alpine skiing were studied, 8 of which were used in this article.

Results of the study and discussion. The specialists of Shanghai Sport University Y. Yao, H. Niu [6] developed a system of indicators for monitoring the physical fitness of elite freestyle acrobats. The developed control system is based on the principles of standardization of results and takes into account three key aspects: specific indicators of fitness, their factor weight and the scale of standard values. The use of cluster analysis made it possible to select the most important indicators of physical fitness for elite

acrobats, divided into three factor groups: physique, physiological function and physical qualities. It was found that the greatest influence on the sports results of elite athletes in acrobatics is exerted by the factor of physical qualities (the factor weight for men was 0,42, for women – 0,41), in second place in terms of influence was the factor of physiological function (the factor weight for men – 0,33, for women – 0,32), in third place was the factor of physique, the weight of which for men was 0,25, for women – 0,27. The indicators of acrobats' fitness control in the body type factor group were the length of the Achilles tendon, the width of the pelvis, the circumference of the pelvis and the Quetelet index. The hemoglobin level, the relative maximum anaerobic power and the oxygen concentration were assigned to the physiological function factor group. The indicators of the physical qualities factor group were pure strength, the number of squats on a balance beam with a raised barbell, a 30-meter sprint and a 12-minute run. The use of the developed control system made it possible to determine the general and ideal model of physical fitness of Chinese elite acrobats.

The use of this control system allowed these same specialists [7] to determine the champion model of physical fitness for freestyle acrobats in preparation for the Olympic Games in Beijing. It was found that elite acrobats have the following model characteristics in such indicators as: lean body mass (59,2 kg for men, 47,1 kg for women), waist/height 100 (45,26 for men, 44,49 for women), leg length/height 100 (58,64 for men, 58,76 for women), relative MAM (16,48 W/kg for men, 14,45 W/kg for women), relative VO2max (49 ml/min for men, 46 ml/min for women), blood urea (6,03 mmol/l for men, 3,60 mmol/l for women), one-time squat with a barbell (170 kg for men, 135 kg for women), overhead squats on balance beams (9,06 s for men, 9,43 sec women), lateral sword throw (6,39 m men, 6,05 m women), 30-meter sprint (3,98 sec men, 4,70 sec women), 12-minute run (2800 m men, 2740 m women).

M. Eadon from the University of Calgary [8] studied the limits of aerial twisting technique of acrobats in competition conditions using computer modeling during the performance of a triple somersault with five rotations. Various asymmetrical movements of the arms and hips creating rotations during the flight were studied in order to maximize the twisting and to ensure the tuck before landing. It was found that when performing a triple somersault, acrobats can perform four to six rotations (twists). The main limiting factor is the increased frontal moment of inertia of the whole body due to the equipment (outfit and skis), which limits the amount of tilt. Reducing the weight of the equipment may make acrobatic movements easier to perform, but is unlikely to allow one to advance beyond the established limits.

D. Howe, J. Renaud, M. Durand [1] studied the technique of competitive exercise of athletes in acrobatics. It was established that the structure of the competitive exercise in acrobatics consists of six successively performed phases: increasing speed on the descent (acceleration), body control while sliding along the transition section of the ski jump, takeoff, body control while «exiting» the ski jump, performing acrobatic tricks and organizing the landing.

During the acceleration, acrobats pay attention to «skis sliding on the snow», «weather conditions», «the speed with which they arrive in the area before the jump», «how they use the sliding area», «how they climb the ski jump in comparison with the previous jump».

During the transition, acrobats assessed their readiness for the future takeoff by analyzing their stability during sliding. Based on the analysis of the listed conditions, acrobats can change the way they perform an acrobatic trick. In the take-off phase, acrobats focus on achieving the ideal position for take-off from the ramp. At this point, athletes pay great attention to the feeling of transition from a supported glide to an unsupported position in the air.

The next phase includes three key components: body positioning for the initial rotation (the initial part of the acrobatic jump), continuation of the rotation (the central part), and checking the jump (the final part). In the initial and central parts of the jump, athletes focused on «reaching a certain expected moment». These moments were «the end of the rotation» or «the ability to determine your location in flight and during the rotation».

In the final part of the jump, athletes analyzed the deceleration of the rotation speed, controlled the spread of the arms, and examined the landing zone. In the landing phase, acrobats estimated the time until contact with the slope, the probable landing point.

Chinese scientists [5] have found that eight weeks of core stabilizing muscle training improves landing kinetics in freestyle acrobats. During the study, 18 acrobats were divided into two groups: experimental and control, nine people in each. During the experiment,

the EG acrobats performed a specially designed training program aimed at developing the core stabilizing muscles. This program was performed by the EG athletes twice a week for eight weeks as a supplement to skills training. The training program consisted of the following exercises: abdominal bridge with opposite support, glute bridge with one leg, side bridge, abdominal and back bridge with Swiss ball, V-pull up, back hyperextension, seated diagonal rows with Swiss ball, seated incline pull-ups with Swiss ball, bent-knee dips with side crunches, torso twists, standing shoulder press, single-leg Swiss ball press with one-armed dumbbell, shoulder press, single-leg squat with Swiss ball, supine hip curl with one leg on foam roller, single-leg handstand with eyes closed, single-leg handstand with side lunge, single-leg box jump. After the end of the experiment, the EG athletes significantly and statistically significantly outperformed the CG acrobats in landing kinetics ($p<0,05$). Scientists from the University of Auckland [2] studied the prospects of complex biomechanical analysis in moguls. The specialists developed a special device to measure the effect of force on moguls skiing technique. This device was installed between the ski boot and the binding. During the study, the following indicators were used to assess the perception of moguls of their performances: safety, stability, speed, edging, cushioning, tilt, and overall performance. For the kinematic analysis of the moguls' movement technique, it was proposed to use the knee tilt angle, the torso and hip tilt to the sides and forward, as well as the trajectory of the body's center of mass. All the assessed parameters showed a tendency to improve from the first to the last performance.

The specialists of the Pacific Sports Institute of Canada conducted an analysis of the jumping results of world-class mogul skiers over the four-year Olympic cycle from 2006 to 2010 [4]. The control tests for explosive power were the squat jump, standing jump, depth jump and jumping off a block. The analysis of the results showed that men and women generally improved their results in explosive power from the first to the fourth year of training. The greatest increase in explosive power was noted between the first and second years of training. The minimal increases in results between the third and fourth years are explained by the use of a block of corrective exercises for the purpose of injury prevention. Explosive power is the most important component in moguls, clearly distinguishing athletes by their level of preparation at the World Cup stages. I. L fqvist and G. Bj rklund conducted a study to measure the force experienced by slopestyle skiers when landing after a long-distance jump [3]. Tensometric insoles were used to assess the force. The results showed that athletes who performed a 180° jump experienced a force of 1446±367 N upon landing, while when performing a 180° switch jump, the landing force was 1409±257 N. Thus, a force twice the body weight can be considered the minimum value for slopestyle skiers.

Conclusions. Thus, the conducted review presents modern trends in scientific research of sports training in freestyle, the results of which can be used by coaches and specialists in the implementation of the training process in such freestyle disciplines as: acrobatics, mogul and slopestyle.

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Preserving the functional asymmetry of the muscular system in young hockey players through compensatory exercises

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Abstract

Objective of the study was to assessment of the interplay between the integration of remedial exercises into training and the outcomes of specific assessments for young hockey players.

Methods and structure of the study. The participants in the research were young hockey players aged between 13 and 14. The hockey players underwent a series of training and evaluation throughout the course of a single season. The players engaged in a 45-minute twice-weekly training regimen that included exercises designed to strengthen the core muscles, enhance flexibility, and improve joint mobility.

Results and conclusions. Corrective exercises can mitigate the adverse consequences of unilateral exercises and decrease the likelihood of overexertion for the athlete. The process of corrective exercises is based on the comprehensive improvement of joint flexibility and mobility, as well as the ability to move in different directions while skating and using a stick and puck.

Keywords: *junior hockey players, functional symmetry, compensatory exercises.*

Introduction. The informative characteristics that determine the manifestation of physical qualities and the processes of adaptation to training loads include anthropometric and morphological parameters of athletes. Control of anthropometric dynamics based on systematic monitoring of physical development allows recommending the most preferable sport to beginning athletes and helps to predict sports results [1]. The systemic accentuated impact of physical exercises on individual aspects of physical potential can have a destructive effect on the functional and coordination indicators of young athletes [4, 5].

Repeated exercises performed by young hockey players unilaterally overload the musculoskeletal system, most negatively affecting the muscles of the shoulder girdle, hip, lumbar spine, and deep back muscles. Due to a decrease in elasticity and active tone of muscles that provide spatial stability and dynamic balance, muscle imbalance occurs, which entails a decrease in sports results [3]. Presumably, one of the most effective methods of comprehensive training of muscle groups are compensatory exercises that have a harmonizing effect on the physical development and balanced functioning of the kinematic links of the musculoskeletal system of young hockey players.

Objective of the study was to assessment of the interplay between the integration of remedial exercises into training and the outcomes of specific assessments for young hockey players.

Methods and structure of the study. The study participants were players of the youth hockey team aged 13-14 years (height – 159,8 ± 5,3 cm; weight – 50,4 ± 4,2 kg). The study participants were divided into an experimental (12 athletes) and a control group (11 athletes). Before the study, the group participants

had a homogeneous level of fitness. The homogeneity of the initial level of fitness of the athletes was statistically confirmed by preliminary testing. The control group of hockey players trained according to the standard of training of athletes approved by regulatory documents. The longitudinal study was carried out at the State Budgetary Institution of Additional Education «Moscow Hockey Academy». The study analyzed the dynamics of anthropometric indicators of young hockey players of the Sports School «White Bears». For the actual analysis of game technical and tactical indicators, systematic collection of game data was carried out in accordance with the theory and practice of sports selection and early orientation in sports [2]. Monitoring the dynamics of game techniques indicators, along with measuring the results of mastering special training tools for hockey players in the EG and CG, was carried out to maintain the versatile physical fitness of athletes, the proportionality of which was determined by the effectiveness of the implementation of hockey playing techniques.

Hockey players underwent a training and testing cycle during one game season. Compensatory exercises were performed by players for 45 minutes twice in a weekly training cycle. Pedagogical impact was provided by exercises to strengthen the muscles of the trunk, improve flexibility and mobility in the joints in order to increase the maximum amplitude of movements. Repeated testing was carried out in the final phase of the annual cycle. The effectiveness of the training work was assessed using the t-test for dependent samples at the significance level.

System requirements for the coordination of actions of young hockey players when performing compensatory exercises consisted of performing game actions in one and the other direction with a large amplitude of skating and movements, under the left and right hand of stick and puck control. The training effect of compensatory exercises was assessed by the number of speed-strength and coordination-oriented game techniques performed by young hockey players with rational use of body parts with different ranges of motion.

Results of the study and discussion. Testing at the end of the experiment made it possible to identify the effectiveness of the young hockey players' performance of technical and tactical techniques (see table).

The training factor causing adaptive reactions was the compensatory transformation of the functionality of training effects during a diverse physical load on various parts of the body involved in performing game techniques. According to the dispersion measure of the distributed random variable, the percentage performance was expressed by the median (50%) on the percentile scale. This parameter indicates the placement of players within the reference group. The studied indicators classified above the average team game profile can be considered indicators of a high level of preparedness of an individual player.

The transition to a higher speed and amplitude mode of operation of the biomechanical links of the body proves that as a result of the use of compensatory exercises for the purpose of additional stimulation of the working muscle groups and structural components of the joints, a new neurophysiological state of young hockey players is formed, which is manifested in an increase in the effectiveness of game techniques: throwing the puck - by 14,8%, passes to the forward - by 14,7%, dribbling with dribbling of the opponent - by 12,4%, shots on goal - by 16,5%, puck tackling - by 16,6%, power techniques of the game - by 15,1%. The predicted increase in overall flexibility and local mobility in the main joints of the body, postural dynamic balance and strength capabilities of the trunk muscles expanded the possibilities of using the tech-

Efficiency of young hockey players' performance of technical and tactical techniques of the game, $\bar{x}\pm m$

Indicator	Number of effective techniques		
	EG	CG	t
Throwing the puck in	5,9±0,2	1,6±0,2	1,5
Dribbling the opponent	16,8±0,5	11,6±0,5	4,2
Passing to the forward	11,8±0,5	6,1±0,6	0,8
Shots on goal	3,8±0,5	1,9±0,6	0,5
Taking the puck away	13,9±0,4	1,7±0,3	2,1
Power plays	17,8±0,5	8,1±0,4	1,9

nique of holding the stick with both hands in amplitude skating by hockey players of the experimental group when performing game techniques that require an integrated manifestation of technical coordination and mobility in the joints. Although mastering basic game techniques lays the foundation for stick and puck handling and skating techniques, due to the low variability of actions it creates prerequisites for unilateral overstrain of individual body parts and, as a consequence, contributes to the development of functional asymmetry. Subsequent attempts to master the requirements of modern hockey do not have significant success due to the dominance of the established unilateral stereotype of movements. The consistent implementation of the tasks of training mesocycles also provided for the selective selection of the structure of compensatory exercises based on the principle of complex impact on the development of game abilities, both in defense and in attack.

Activation of the functional capabilities of young hockey players was achieved due to the accumulation of a multifaceted compensatory effect with the systematic use of compensatory exercises. The resonant nature of the adaptive reactions of the athletes of the experimental group in mastering the complex coordination of a hockey player is based on the integral focus of training tools that take into account the positional location of the player when performing game actions and his ability to play on multidirectional trajectories of movement. In response to the impact of a multifaceted physical load, multidirectional adaptive reactions of the body occur, contributing to the selectively accentuated development of the skills of young hockey players in accordance with the specifics of the game, which requires a coordinated manifestation of coordination abilities and mobility in the joints. In changing conditions of the game environment, a decrease in the elasticity and active tone of the muscles that ensure spatial stability and dynamic balance is compensated for by performing work with a change in the usual limbs, a change in the direction of movement, the sides of the site, the vector of attack of the opponent's goal. The ability to change the usual tempo and rhythm, formed through the development of compensatory exercises, ensured the variability of the implementation of the functional and coordination components of the hockey players' athletic skills.

Conclusions. Compensatory exercises help to smooth out the negative side effects of unilateral exercises performed by hockey players, as well as reduce the risk of overloading the athlete's body. Evaluation of the effectiveness of individual and group game techniques is the basis for designing exercises that include compensatory, stabilizing and strengthening options for special exercises. The mechanism of action of compensatory exercises is based on the comprehensive development of flexibility and mobility in the joints, skating and handling of the stick and puck in various directions and for any hand.

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Instructing the method of ball shooting in the practice of young basketball players

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Abstract

Objective of the study was to assess the significance of ball-handling skills in the context of basketball and to explore the methods employed by coaches to teach these skills in early-stage training programs.

Methods and structure of the study. The following methods were used: analysis of scientific literature, pedagogical observation, interview, analysis of competitive activity, processing of research results. We reviewed and analyzed 54 games of the 15th international club basketball tournament among professional teams from Eastern Europe of the VTB United League in the 2023/2024 season, 33 games of the 1st round of the MLBL Championship-Ural Siberia Children among young men born in 2010 and 2012. 18 coaches of youth teams participated in the interview.

Results and conclusions. Over the past 10 years, technical and tactical actions in basketball have changed. The reason for this was a rule change in 2013 that limited the time for subsequent attacks after the first one to 14 seconds. The main emphasis in the attack began to be placed on players who, in case of time constraints, using complex and delicate ball handling, beat their opponents and complete the attack with an effective throw. The total average time of driving the ball in a basketball match was revealed. There are five main blocks of exercises aimed at teaching the technique of leading the ball in the groups of initial training, which are basic in the «ball school» of young basketball players.

Keywords: *modern basketball, dribbling in basketball, basic principles of dribbling technique in basketball.*

Introduction. Throughout the history of basketball, the rules and techniques of game techniques have changed many times. The latest change was a reduction in attack time, which forced many coaches to look for options, methods and means of dribbling the ball by all team players. The study of this problem is the most urgent today.

Modern scientific literature covers theoretical and practical issues of sports training of basketball players of various levels quite well. But the issues of training young basketball players are much less well covered. The main issue that is not reflected is the school of the ball. Thus, in the study of M.A. Sergazinova [3] it is noted that basketball players of the Russian national teams are inferior to foreign ones in the skills of beating an opponent with dribbling the ball. She sees the main problem in this in the outdated methods that are used in initial training groups, as a result of which there is a limited set of skills in using this technique.

Objective of the study was to assess the significance of ball-handling skills in the context of basketball and to explore the methods employed by coaches to teach these skills in early-stage training programs.

Methods and structure of the study. The following methods were used: analysis of scientific literature, pedagogical observation, interview, analysis of competitive activity, processing of research results. We reviewed and analyzed 54 games of the 15th international club basketball tournament among professional teams from Eastern Europe of the VTB United League in the 2023/2024 season, 33 games of the 1st round of the MLBL Championship-Ural Siberia Children among young men born in 2010 and 2012. 18 coaches of youth teams participated in the interview.

Results of the study and discussion. We have analyzed the domestic scientific literature for the last 10 years. It can be noted that the research in the field of basketball was diverse, touching on various aspects of this game.

One of the important ones, in our opinion, was the study of the modern concept of dribbling in basketball. The authors [2] watched and analyzed the matches of the men's and women's teams of the 2016 Olympic Games. During the observations, they recorded more than twenty types of dribbling that were difficult to coordinate and determined the average time spent on this technique by players per attack. Thus, for men it was 7 seconds, for women 6. In their study [1], they systematized and classified the dribbling technique in modern basketball. In their systematization, 64 classes of dribbling and 72 classes of game situations for the possible use of dribbling were identified. Such a variety of dribbling techniques radically changes the approaches to teaching this technique. In support of this opinion, we conducted pedagogical observation of the games of the 15th international club basketball tournament among professional teams from Eastern Europe of the VTB United League in the 2023/2024 season. The object of observation was the total time of ball possession using dribbling by each of the teams during the game time. The results of the observation are presented in the table. The data analysis showed that, on average, each of the teams spent over 25% of the game time on game activities. Thus, the minimum time spent on dribbling the ball per quarter in the games watched was 1 min 47 sec, the maximum was 3 min 19 sec.

If we take into account the fact that the ball is held alternately by two teams, it can be argued that in the total playing time both teams spent over 50% on dribbling. Thus, dribbling is the main element of the game, without which the effective activity of the team and a specific player in particular is impossible. In the study [4], when observing the games of the Higher League of the Russian Championship and the Russian Basketball Cup, the importance of dribbling was considered in organizing a fast break, in a positional attack, in an attack against a personal and zone defense system. Attention was paid to the mistakes that the players made when organizing attacks. Thus, one of the significant mistakes was the inability of the players to use both their right and left hands equally. It is necessary to take into account that in most cases, dribbling is carried out under active opposition from defenders, in connection with which the meaning and requirements for performing this technique become clear. Thus, in the proposed methodology for preparing a basketball team for a quick breakthrough, coaches had to make up for the omissions in the technical training of athletes made at the initial stages of sports training. We watched the games of the 1st round of the current MLBL-Children Ural Siberia Championship among young men born in 2010 and 2012. Observation showed that each team adhered to its own specific tactics of playing in attack. For the attack, some teams had the same point guards. In

Results of the teams' spending of playing time on dribbling the ball in matches (n=54)

Teams	Average time (Xcp) of dribbling the ball in each quarter (min)				% dribbling time per match
	1 quarter	2 quarter	3 quarter	4 quarter	
Avtodor	02:27	02:43	02:44	02:38	25,8
Astana	02:35	02:32	02:51	02:41	25,9
Yenisei	03:06	02:17	02:52	03:16	28,3
Zenit	02:39	02:49	02:31	02:56	26,4
Lokomotiv-Kuban	02:43	02:37	02:56	02:55	27,8
MBA	03:00	02:52	02:39	02:46	27,9
Minsk	02:47	02:42	02:49	02:52	27,7
Paris Nizhny Novgorod	02:51	02:41	02:35	02:29	25,9
Parma	02:40	02:51	02:36	02:53	27,5
Runa	02:34	02:28	02:42	02:33	25,4
Samara	02:27	02:46	02:37	02:42	25,8
UNICS	02:40	02:43	02:37	02:34	25,8
Uralmash	02:35	02:45	03:01	02:50	27,8
CSKA	02:36	02:33	02:47	02:20	25,4
TOTAL	02:41	02:40	02:44	02:45	26,25

others, the tactics were used to start attacks by using three players, numbers 1, 2 and 3. Only in a few teams could any player from the five start an attack. In almost all games, the attack ended after the first attack either with a successful basket, or a turnover, or a penalty throw. The second attack was rarely played. In cases of ball recovery by the attacking team, often only one technical and tactical action was performed – a three-point throw from the arc. When observing the game of participants who carried out an attack with dribbling, the following problems with dribbling technique were identified: the ball was brought out to the leading hand before the throw – the non-leading hand was rarely used; the throwing movement with two steps began at the beginning of the dead zone of the shield – the player had to lean back to throw; high dribbling during an attack from the arc, as a result of which there were many losses of the ball; receiving the ball for an attack with subsequent dribbling was carried out on straight legs, which led to a loss of time for the beginning of the attack. Few young athletes demonstrated good ball schooling.

In this regard, we interviewed coaches working with initial training groups and 1st and 2nd year training groups. The purpose of the interview was to identify exercises used to teach dribbling techniques. A total of 18 people were interviewed. All had higher education, specializing in basketball, first and highest qualification category. Work experience ranged from 6 to 23 years.

As a result of the interview, we found out that dribbling is given attention at almost every training session. In initial training groups, all students are involved in this process according to the general methodology. In training groups, the training process includes classes with technical and tactical actions using dribbling taking into account the future role. In the training process, according to the coaches (77%), it is necessary to constantly monitor the technique of dribbling. When discussing the tools used by coaches to teach dribbling techniques, we identified several blocks of exercises:

- exercises to control the ball while dribbling;
- exercises to teach how to start dribbling;
- exercises to beat the opponents' defense;
- exercises to pass the ball while dribbling;
- exercises to attack the hoop using dribbling.

Each of the blocks includes exercises aimed at solving similar, but at the same time diverse tasks.

When discussing the issue of the versatility of a player who can do the job of any number on the court, the opinions of coaches were divided. Almost 72% (13 respondents) are of the opinion that children have different levels of skills, so the main task of a coach is to develop them to the maximum level. In this regard, already at the early stages of sports training, they try to determine the future role of the child.

The rest of the coaches, 18% (five respondents), have a completely different point of view. They believe that players should be versatile. In their opinion, there should be no one-dimensional players in modern basketball. A successful and effective player is considered to be one who is well-rounded, and the team's success is possible only when each player on the court can do everything.

We also tried to find out what tests coaches use in their work to determine the quality of dribbling technique. We were offered various options for dribbling with racks, without racks, using chips, cones and special devices in the form of basketball dummies of defenders. At the same time, they believe that there is no test that would be informative for all indicators, so we have to resort to several.

The coaches identified several indicators as criteria for the requirements for ball handling technique. In first place, they consider the player's ability to use the right and left hand at the same level with asynchronous work of the arms and legs. The second criterion was the ability to correctly hold the body position, that is, to be in a basketball player's stance. Indicators such as the ability to move at high speed with elements of abrupt stops and sudden jerks were also noted. An important criterion, the coaches highlight is the ability to dribble the ball without visual control.

Conclusions. Based on the above, it can be stated that:

1. Dribbling in a basketball match by both teams takes up over 50% of the game time. This technique is important in competitive activities.

2. Basic elements of dribbling technique should be laid at the initial stage of sports training with constant monitoring of the main characteristics during execution.

3. In the galaxy of children's coaches, there are two points of view on the functional significance of a player on the court, which determines team technical and tactical actions on the court. Teams without clearly expressed roles on the court, with a well-established base of dribbling technique, looked more

successful in competitive activities in the tournament we watched.

4. During the interview with coaches, five blocks of exercises were identified aimed at dribbling technique. Most of the exercises are standard, without the possibility of making independent decisions.

5. There is a real need to develop new teaching aids aimed at improving the quality of ball handling in initial training groups, taking into account the model characteristics of modern basketball.

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The effects of boxing training on the physical condition of first-year students

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Abstract

Objective of the study was to assess the intensity of the physical response of first-year students to boxing training during the initial phase.

Methods and structure of the study. Thirty-two young men were chosen from the student population at the university, creating two groups of young students. One group consisted of 18 individuals who began boxing training, while the other group included 14 individuals who did not wish to participate in sports. These individuals were monitored for a period of one year. The study employed a method of testing and a method of statistical analysis.

Results and conclusions. The boxing classes enhanced physical activity and boosted endurance among participants. The students' stamina improved, enabling them to handle greater loads. The boxing regimen enriched the repertoire of learned movements, enhanced speed and power, and refined the coordination of those involved.

Keywords: *boys, students, sports boxing, physical abilities, motor characteristics.*

Introduction. Increasing the physical activity of students, especially first-year students, is a pressing issue for the educational system due to the heavy workload of students in the educational process [4]. This problem can be solved by involving students in various types of martial arts that can satisfy the need of young people for competition, physical development and social involvement [1, 3].

Objective of the study was to assess the intensity of the physical response of first-year students to boxing training during the initial phase.

Methods and structure of the study. From the students who started their education at the university, 32 young men were selected, who formed two groups of different physical activity. One group included 18 students who started regular boxing training, the other included 14 people who did not want to do sports. The novice boxers trained under the supervision of an experienced trainer twice a week for one hour. To assess the dynamics of physical capabilities in the control group and in the boxer group, tests were used to assess physical capabilities. In the control group, testing was performed once. Boxers were tested initially and then at an interval of 6 months. Student's t-criterion was calculated using a computer.

Results of the study and discussion. All the students under observation had poorly developed muscles of the limbs and trunk, as well as the cardiopulmonary system. This was manifested in those observed by a low level of physical capabilities (see table) in both observation groups. In conditions of physical activity, a feeling of fatigue set in early in the groups. This was accompanied by an increase in the number of irrational movements in young boxers, their slowing down and weakening of attention to the details of the fight and to the behavior of the opponent. Those who expressed a desire to

Physical development of boxers

Applied tests for assessing physical capabilities	Control group, M±m, n=14	Classes in the boxing section, M±m, n=18		
		Before classes begin	6 months of boxing	12 months of boxing
Long jump from a standing position, m	1,42±0,38	1,43±0,43	1,86±0,19 p<0,01	2,04±0,23 p<0,01
Distance covered in 6 minutes, m	958,6±25,14	962,3±22,19	1124,3±39,49 p<0,05	1315,6±41,03 p<0,01
Possible number of pull-ups, repetitions	5,1±0,47	5,3±0,51	8,2±0,32 p<0,01	13,6±0,25 p<0,01
Torso lifts from a horizontal position during 1 minute, repetitions	21,3±0,31	22,5±0,43	34,2±0,71 p<0,01	47,4±0,61 p<0,01
Duration of shuttle run 4x9, s	14,4±0,62	14,2±0,58	10,8±0,69 p<0,01	8,7±0,35 p<0,01
Jumping rope for 25 sec, repetitions	22,1±0,91	23,5±0,87	35,8±0,58 p<0,01	44,5±0,42 p<0,01
Running a distance of 30 m, s	6,2±0,57	6,1±0,46	4,9±0,31 p<0,01	4,2±0,25 p<0,01
Running a distance of 60 m, s	10,9±0,72	10,7±0,63	8,8±0,53 p<0,01	7,9±0,47 p<0,01

Note: p – significance of the dynamics of indicators.

attend the boxing section had low strength development, judging by the small number of pull-ups performed. At the beginning of the observation, the boxers' group had low speed-strength indicators. Judging by the results in the running tests, the jump test and the body lifting test, this group had low endurance, running a short distance in 6 minutes. Before training, the future boxers demonstrated modest coordination, which was confirmed by their 4x9 shuttle run time and the result of the jumping test with a rolling pin (see table).

During the observation of the trainees, their monitored parameters moved away from the initial level and the values characteristic of the control. After 6 months of training, the young men noted a weakening of the feeling of fatigue from training in the section, which disappeared after 12 months of training. Under the conditions of regular physical training in the section, the examined young men showed an increase in their physical capabilities. The growth of the strength capabilities of the young boxers was indicated by an increase in their ability to pull up – by 60,8% by 6 months of training, by 2,7 times by 12 months of training. The achieved increase in their speed-strength capabilities was indicated by a reduction in 30m running time by 24,5% and 45,2% and 60m running time by 21,6% and 35,4%, an increase in long jump by 30,1% and 42,6% with an increase in body lifts in one minute by 52,0% and 2,1 times, respectively, at 6 and 12 months of observation. Against this background, there was an improvement in coordination, as indicated by a decrease in the duration of the shuttle run test by 31,5% and 63,2% and an increase in the number of jumps with a skipping rope by 52,3% and 89,4%. An increase in endurance in those training was confirmed by an increase in the distance of a six-minute run by 16,8% and 36,7%, respectively, at 6 and 12 months of training. Regular muscle activity in the conditions of training in the boxing section caused muscle hypertrophy in different muscle regions. Muscle development was facilitated during training by the enhancement of macromolecule biosynthesis in myocytes, activation of reparation phenomena in them and generation of macroergs [2]. The emerging situation minimized the risk of various dysfunctions in boxers, maintaining a high level of health in those who trained. These changes in those who began to engage in boxing led to an increase in the physical development of the young organism, associated with an increase in the reserve capacity of the organism, muscle strengthening and enrichment of the set of learned movements [3]. The revealed gradual enhancement of locomotor characteristics in those engaged in the boxing section was ensured by an increase in the development of muscles supporting posture and ensuring body movement in space with the functional improvement of the vestibular apparatus structures as the training experience increased [4].

Conclusions. Regular muscular activity of students in the boxing section has an activating effect on physical parameters. As the experience of boxing training increases, positive dynamics of physical characteristics are observed. An increase in the accuracy of movements and functional improvement of life-support organs was achieved. As a result, as the experience of training increases, boxers' endurance, strength, coordination and speed parameters increased. Irregular physical activity during educational physical education classes did not lead to the physical development of students. For this reason, it is justified to recommend regular boxing training for long periods of time to student youth, designed to increase the level of physical capabilities, form the basis for successful mastering of the curriculum of the future profession.

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The incorporation of a series of acrobatic movements into the training regimen of gymnasts

UDC 796.4

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Abstract

Objective of the study was to theoretical foundation for acrobatic training in rhythmic gymnastics, creating a comprehensive set of acrobatic exercises through the integration of non-objective training methods.

Methods and structure of the study. Examination of literary materials and pedagogical observation of gymnasts' training sessions. The study focused on gymnasts in the sports improvement and advanced sports categories, who were training under the CMS and MS programs.

Results and conclusions. The article provides a scientific rationale for the significance of acrobatic training in rhythmic gymnastics. The article outlines the methods and presents a collection of acrobatic exercises that are based on the integration of non-objective training techniques.

Keywords: *acrobatic training, rhythmic gymnastics, acrobatic elements, non-objective training.*

Introduction. Non-objective training is the process of developing and improving the technique of «Body Difficulty», which includes balance-rotational, jumping, acrobatic training, as well as various specific movements. Non-objective training is the foundation for the development of a gymnast [4]. Successful mastering of technical groups of difficulty (jumps, rotations, balances), at various stages of sports training, determines the value of the competitive composition, respectively, the competitiveness of the gymnast herself [3].

One of the components of non-objective training of gymnasts is acrobatic training, which includes a number of effective means of improving motor actions. Acrobatic exercises contribute to the development of resistance to unplanned accelerations, speed of motor reaction and body movement in space. Pre-acrobatic elements add contrast and amplitude to the composition due to transitions from a standing position, to a lying or sitting position, emphasizing the nature of the musical accompaniment.

It has been determined that there is a relationship between vestibular stability and the performance of complex coordination exercises related to balance and rotation [1]. The ability to differentiate the body in space and the quality of the formation of motor skills depend on vestibular stability [2].

Objective of the study was to theoretical foundation for acrobatic training in rhythmic gymnastics, creating a comprehensive set of acrobatic exercises through the integration of non-objective training methods.

Methods and structure of the study. Analysis of literary sources, pedagogical observation of the training process of gymnasts. The study involved gymnasts included in the group of sports improvement and higher sports mastery, performing according to the CMS and MS program. The means of the developed complex of combined focus were acrobatic, jumping, balance-rotational exercises.

Results of the study and discussion. Rhythmic gymnastics is a complex coordination sport. Its distinctive feature is the performance of various motor actions in one competitive composition: balances, jumps, rotations, acrobatic movements and manipulations with an object.

Modern competition programs include a significant number of pre-acrobatic elements, which are used not only to enhance the spectacularity of the competitive composition, but also to increase the technical value of both individual and group exercises. However, the value of acrobatic training lies not only in teaching specific pre-acrobatic elements, which are basic for mastering motor actions of increased complexity, but also in improving the vestibular stability of gymnasts, determining the position of the body in space, speed and reaction speed.

At the stage of sports improvement and higher sports skills, acrobatic training can be combined with balance-rotational and jumping training, which provides additional opportunities to improve the level of sports skills of gymnasts.

In the course of the conducted research, a set of exercises of acrobatic orientation was developed, based on the combination of means of non-objective training.

The main means of the acrobatic complex based on the combination of types of non-objective training

№	Types of non-objective training	The means of the developed set of exercises
1.	Acrobatic training	1. Somersaults (forward, backward): - from a standing position; - from a kneeling position. 2. Rolls: - over the shoulder; - over the chest. 3. Somersaults (forward, backward, to the side): - from two legs (straight legs, through extension); - from one leg (with a change of legs); - a somersault «barrel» from a kneeling position to the starting position; - a somersault «barrel» from a kneeling position with a transition to a handstand; - a somersault in a forearms stand (forward, backward); - a somersault in a forearms stand into a split. 4. «Changes». 5. «Dive»: - «step into a somersault»; - a push of both legs. 6. «Getting up from the rises»
2.	Equilibrium-rotational training	1. Static balances of various variations standing on one leg, the other at an angle of 90 degrees: - «arabesque», «attitude», balance with a leg forward without using hands, «passe» (forward, to the side). 2. Static balances of various variations standing on one leg, the other at an angle of 180 degrees: - using hands (forward, to the side, «in a tightening», «in a ring», «lateral»); - without using hands «planche», «lateral», «back». 3. Dynamic balances of various variations on one leg, the other at an angle of 90 degrees: - «turlyany». «Arabesque», «attitude», balance with a leg forward without using hands, «passe» (forward, to the side). 4. Dynamic balances of various variations on one leg, the other at an angle of 180 degrees: - «turlyany». With the help of hands (forward, to the side, «in a tightening», «in a ring» «side». Without the help of hands «planche», «side», «back». 5. Dynamic balances with elements of rotation: - «helicopter»; - «reverse helicopter»; - rotations of no more than 360 degrees. «Chene», «spiral turn»
3.	Jump training	1. «Simple» jumps: - «split legs». 2. Jumps with a push of two legs: - «ring with two», «touching the ring»

The objectives of the developed set of exercises:

- increasing the level of athletic skill of gymnasts;
- increasing the level of technical training;
- developing and improving physical abilities.

The means of the developed set of exercises are presented in the table.

The structure of the developed acrobatic complex with the use of non-objective training means includes both general pedagogical principles applied for a pedagogically organized process and principles of sports training, which determined the necessary connections between the training impact and their effect.

This set of exercises is aimed at increasing the motor potential of gymnasts. All movements have a clear sequence of execution. The complex consists of several «acrobatic tracks», including exercises of a combined nature. The distance of one «acrobatic track» is equal to the distance of the competition area, in accordance with the FIG rules for the sport of «rhythmic gymnastics» (13x13 m). All exercises were performed in a «flow» movement, in pairs or threes, with the «working» and «non-working» leg. The duration of the complex is 40 minutes.

The complex includes «acrobatic tracks» of various directions:

- high-speed «acrobatic tracks». The combination of exercises is performed in the fastest possible sequence. Includes acrobatic training means. 3-4 different «tracks» for the whole complex;

- power «acrobatic tracks». Include acrobatic training tools. The tempo of execution is slow. 2-3 different «tracks»;

- «acrobatic tracks» with elements of balance-rotational training. Include balance-rotational training tools with the addition of acrobatic exercises. In these «tracks», acrobatic exercises are used for a logical transition from one position to another, for example: starting position balance «arabesque», on «relev» (8 counts hold the position), transition to «planche» (8 counts), forward somersault, exit to «back» (8 counts), transition to balance with the leg forward using the hands, on «relev» (8 counts), lowering onto the whole foot «turlyan». The «track» is performed with the other leg. Mandatory condition: perform the exercises without losing balance and moving from the place (stepping over). 2-3 different “tracks»;

- «acrobatic tracks» with elements of jumping training. The combination of exercises is performed in the fastest possible sequence. Includes means of acrobatic and jumping training, 3 different “tracks»;

- «acrobatic tracks» of combined orientation. As a rule, it begins with elements of balance-rotational training, continuing with means of acrobatic training and finishing with a jumping exercise. 3-4 different «tracks».

As a result of using a complex of acrobatic orientation based on a combination of means of non-objective training, in the training process, a reliable increase in the physical fitness indicators of gymnasts was revealed. The assessment was carried out by a group of qualified experts. The reliability of differences was determined at the significance level ($p<0,05$) before and after using the developed set of exercises. When assessing the coordination abilities in the exercise «forward somersault with fixation of balance in various positions» 3,5±0,47, versus 4,5±0,24, ($p<0,05$). The exercise was assessed on a 5-point scale. Improvement in indicators was observed when assessing the speed-strength abilities of gymnasts in the exercise «split legs», the number of times performed in 15 seconds was determined 12,3±0,67 and 16,8±0,77, ($p<0,05$), respectively. In a comparative analysis of the speed abilities of gymnasts, in the exercise «jumping rope with acceleration from foot to foot» 23,5±0,47 and 26,5±0,47, ($p<0,05$), the number of jumps performed in 20 seconds was counted. The success of including this set of exercises is confirmed by the increase in the result of the competitive activity of gymnasts, as well as the assimilation of elements of increased complexity. Thus, these facts confirm the effectiveness of using the developed set of exercises of combined focus, which achieves sustainable development of sports skills, an increase in the level of physical and technical preparedness of gymnasts.

Conclusions. As a result of the conducted research, the importance of acrobatic training in rhythmic gymnastics for the improvement of the quality of performance of technical groups «Difficulties (jumps, rotations, balances)» was scientifically substantiated. The means were determined and a set of acrobatic exercises was developed based on the combination of means of non-objective training, which can be recommended for use in the training process of gymnasts at different stages of preparation.

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Tests for building model characteristics of physical fitness of athletes aged 16-17 in mas-wrestling

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Abstract

Objective of the study was to selection of essential tests for assessing the physical fitness of young athletes in the sport of mas-wrestling.

Methods and structure of the study. General and special physical fitness was tested for 53 athletes specializing in mas-wrestling, whose age was 16,28± 0,68 years, representatives of weight categories up to 50 kg (15 people), up to 60 kg (13 people), up to 70 kg (25 people). To build model characteristics of physical fitness, a set of pedagogical methods was used. tests and dynamometry to determine the strength of the hand and fingers. The indicators of the athletes' special physical fitness were determined using a modified «Lower Thrust» simulator. A paired correlation analysis was carried out using the licensed IBM SPSS Statistics 22.0 program. The research was conducted on the basis of the V. Manchaara Republican Center for National Sports and the Children's and Youth Sports School № 1. Yakutsk.

Results and conclusions. Closely interrelated indicators of general and special physical fitness were determined based on correlation analysis, where correlation coefficients ranged from r=0,701 to r=0,977, which allowed us to select significant tests for constructing model characteristics of athletes. The complex includes: running 60 m, running 1000 m, long jump from a place, long jump from a place with your back in the direction of movement, hanging on a high crossbar, bending and unbending your arms while lying down, squatting with a barbell, pulling up from hanging on a high crossbar, leaning forward from a sitting position, as well as wrist and finger dynamometry.

Keywords: *mas-wrestling, physical fitness, correlation analysis, construction of model characteristics.*

Introduction. At the present stage of sports development it is impossible to imagine the process of training athletes without monitoring their various components of fitness, especially physical fitness [3-5]. Despite the fact that the national sport of mas-wrestling has confidently established itself in the international arena for the last 25 years, there are still enough questions about the organization and implementation of control, construction of model characteristics of physical fitness of mas-wrestlers of different genders, ages, weight categories and qualifications. There are scientific studies devoted to the issues of conducting pedagogical testing, determining certain indicators of physical fitness, however, these scientific studies mostly concern qualified male or female athletes [1, 2]. In turn, there is a deficit of scientific data regarding the issues of constructing model characteristics of physical fitness of adolescent mas-wrestlers (these include: 12-13, 14-15, 16-17 years old), namely, regarding what tests should be used, how to evaluate the obtained testing data, what evaluation ranges are appropriate to use, etc. In adolescence, scientifically based control of the physical fitness of mas-wrestlers is an integral part of an effective system of sports training, as it allows managing the training process of athletes who have not yet formed, and inadequate load can lead to adverse consequences in the form of overtraining, failure of adaptation, injuries and inability to continue a sports career. Model characteristics of physical fitness, including assessment, allow not only to determine the level of development of physical qualities and abilities, track them in dynamics, but also

to manage the training process, apply the obtained research data for prognostic purposes.

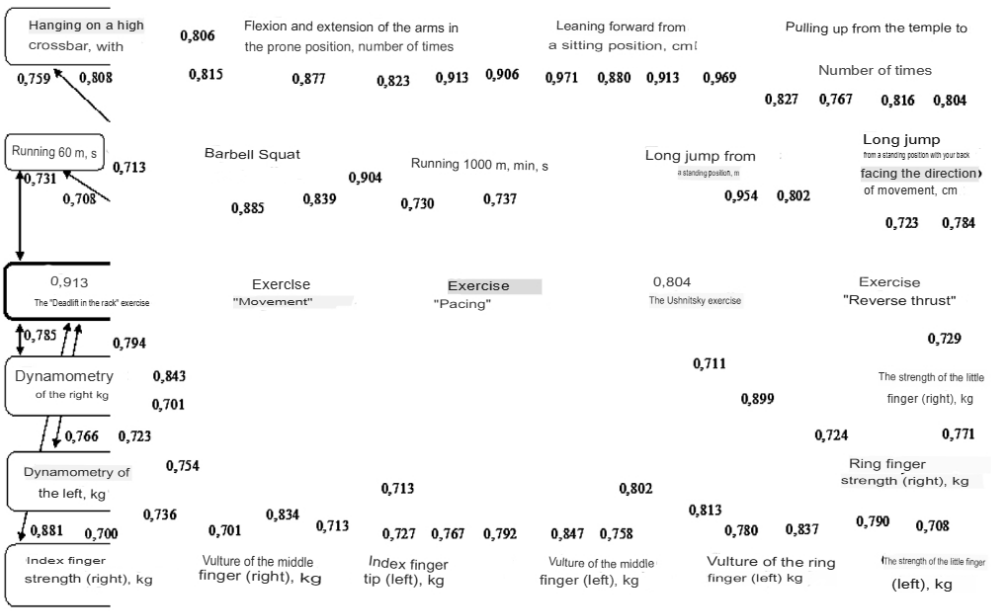
Objective of the study was to selection of essential tests for assessing the physical fitness of young athletes in the sport of mas-wrestling.

Methods and structure of the study. The general and special physical fitness of 53 athletes specializing in mas-wrestling, aged 16,28±0,68 years, representatives of the weight categories up to 50 kg (15 people), up to 60 kg (13 people), up to 70 kg (25 people) were tested. To construct model characteristics of physical fitness, a set of pedagogical tests and dynamometry were used to determine the strength of the hand and fingers. The indicators of special physical fitness of athletes were determined using a modified Lower Pull simulator, on which the athletes performed five exercises: Standing Pull, Movement, Stepping Up, Ushnitsky, and Reverse Pull [3, 5]. A paired correlation analysis of the indicators of general and special physical fitness was conducted using the licensed IBM SPSS Statistics 22.0 program. The studies were conducted at the Republican Center for National Sports named after V. Manchaary and children's and youth sports school № 1 of Yakutsk.

Results of the study and discussion. Using pair correlation, the relationships between the indicators of general and special physical fitness of athletes aged 16–17 years in the weight categories up to 50 kg, up to 60 kg and up to 70 kg were determined. The conducted correlation analysis allowed us to determine that 19 out of 25 indicators of general physical fitness testing of mas-wrestlers are closely related to five indicators of special physical fitness, the correlation coefficients were in the range from r=0,701 to r=0,977.

Indicators in exercises performed by athletes using the modified Lower Pull simulator, such as Reverse Pull and Moving Along the Support Board, correlate to a greater extent with the parameters characterizing the strength of various muscle groups (r=0,804–0,904) and flexibility (r=0,969–0,971). The parameters characterizing arm strength are most closely related to the indicators in the «Stepping Up» and «Ushnitskiy» exercises, where the correlation coefficients are 0,906 and 0,913, as well as speed-strength abilities - r = 0,816 and r = 0,954 and flexibility - r = 0,880 and r = 0,913, respectively. The highest correlation coefficients were found between the indicators in the «Ushnitskiy» exercise and strength, in particular finger strength (r = 0,834 – 0,881) and upper limb strength (r = 0,877) (see figure).

Initially selected exercises for constructing model characteristics of physical fitness based on literary data and by interviewing mas-wrestling specialists, the use of which allowed us to learn the testing parameters, were subsequently subjected to statistical processing using correlation analysis to identify in-



Correlation constellation with a high degree of interrelation between the indicators of general and special physical fitness of athletes in mas-wrestling aged 16–17 in the weight categories up to 50 kg, up to 60 kg and up to 70 kg.

formative tests, which led to a reduction in the number of exercises used and an increase in their informativeness.

Conclusions. To build model characteristics of physical fitness of 16-17 year old athletes specializing in mas-wrestling, weight categories up to 50 kg, up to 60 kg and up to 70 kg, it is advisable to use a set of significant exercises that were selected based on correlation analysis. It included 60 m run, 1000 m run, standing long jump, standing long jump with the back in the direction of movement, hanging on a high bar, bending and unbending arms in a prone position, squatting with a barbell, pulling up from a hang on a high bar, forward bending from a sitting position, as well as wrist and finger dynamometry (index, middle, ring and little fingers).

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The prerequisites for developing club abilities in rhythmic gymnastics based on the coordination requirements of the routines

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Abstract

Objective of the study was to provide a scientific foundation for the development of subject skills in rhythmic gymnastics, in accordance with the coordination profile of the exercises.

Methods and structure of the study. To accomplish this objective, a comprehensive evaluation of the technique for executing the fundamental elements of club activities was conducted by a panel of 15 highly skilled athletes from the Lesgaft National State University. The investigation was conducted during the preparatory phase, spanning from September to December 2024.

Results and conclusions. The primary types of coordination skills for each type of technical elements with maces are identified, along with specific objectives for the development of coordination skills for each type of technical elements with maces. It is discovered that one of the objectives is to teach gymnasts to vary the height of the center of gravity of the maces when executing rotational movements for mills. Additionally, gymnasts are equipped with methodological techniques to enhance their ability to control the direction of an object's descent when performing throwing actions with two maces.

Keywords: *rhythmic gymnastics, individual profile of gymnasts, coordination profile of exercises.*

Introduction. Most studies in the field of sports theory, when considering an individual profile from the position of interhemispheric asymmetry in the context of the success of the development of physical qualities and motor stereotypes [1, 3-5]. In the field of rhythmic gymnastics, the coordination profile of exercises was considered from the position of the criterion for selection and prediction of successful specialization [2]. However, in rhythmic gymnastics, given its specificity, it is necessary to consider coordination abilities not in isolation, but in connection with the work of the object. Knowledge of the coordination profile of exercises will allow a rational approach to the issue of mastering the basic skills of mastering the object. This study examines the basic elements with clubs, as one of the complex types of all-around for young gymnasts in connection with working with both hands simultaneously. As well as the relationship between the expert assessment of the basic work with clubs with indicators of coordination abilities and individual characteristics of athletes.

Objective of the study was to provide a scientific foundation for the development of subject skills in rhythmic gymnastics, in accordance with the coordination profile of the exercises.

Methods and structure of the study. To achieve the set objectives, the following was performed: analysis of scientific literature on the problem of coordination profile of exercises; sports and pedagogical testing, expert assessment, correlation analysis (methods of mathematical statistics). Sports and pedagogical testing implied assessment of indicators of coordination abilities: regulation of dynamic parameters and spatio-temporal parameters of movements (clubs balance (s); ball balance (s); hoop balance (s); accuracy of time reproduction (%); accuracy of spatial charac-

teristics reproduction (%); accuracy of muscle effort reproduction (dynamometry) (%)): rhythm of movements («tactile sensation (lower threshold)» (points); «mass discrimination threshold" (points); reproduction of a given rhythm, small circles with clubs» (%)); static and dynamic balance (Uemura test (points)); orientation in space and time (reaction to a moving object (s); motor asymmetry (s); intramuscular and intermuscular coordination (ability to control hand movements, as well as maintain visual control (%)); degree of muscle tension (myoton) using the Myoton PRO device; change in direction of movement and motor program (test «92-meter run with change of direction «Herringbone» with a windmill with clubs (s); test «Running to numbered stuffed balls» with performing a windmill with clubs in the lateral plane (s)). Expert assessment of the technique of performing basic elements of work with clubs (control exercises: throw, rotation, windmill) was carried out on a five-point scale; correlation analysis of the relationship between types of coordination abilities and expert assessment of the technique of performing basic elements of the object. Fifteen highly qualified athletes of NSU named after P.F. Lesgaft took part in the study.

Results of the study and discussion. When considering the coordination profile of the exercises, the importance of varying the height of the center of gravity of the object was noted, especially when performing the figure eight with the right club in the lateral plane with the left hand (r=0,97) and the horizontal mill with clubs (r=0,86).

The technique of throwing two clubs towards oneself depends primarily on the ability to regulate the direction of the object's fall (r=-0,81). Uncontrolled execution of club throws may result in the loss of the object due to the fact that the clubs fly apart in different directions. Regulation of the time parameters of movements during the opposite throw of two clubs (r=-0,88) allows performing the technical action simultaneously, since mainly due to the fact that the motor skills of the left hand lag behind the gymnast's right hand, the throw with the left hand is performed with a delay. Since most elements with clubs are performed with two hands, the expert assessment of the technique of their execution is largely determined by the accuracy of reproduction of muscle efforts. This is indicated by the revealed correlation relationships between the expert assessment of the technique of throwing, spinning and milling clubs and the dynamometry indicators (0,78≥r≥0,95). The level of development of the ability to regulate dynamic parameters of movements will especially determine the technique of performing a vertical club mill (r=0,95), a throw in the lateral plane with the left hand (r=0,91) and a parallel simultaneous throw of two clubs in the lateral plane (r=0,91).

Intermuscular coordination of the arm muscles is of great importance for performing a throw of two clubs with a movement away from oneself and two clubs with one hand in the lateral plane, as well as the technique of performing a club mill in the vertical, horizontal and vertical planes.

Thus, an inverse relationship was revealed between the expert assessment (scores) and the myotonmetry indicators of the biceps muscle of the arm in a tense state (-0,91≥r≥-0,79). The ability to tense and relax the muscles in a timely manner ensures free rotation of the clubs, especially when performing an asymmetric rotation of the clubs (r=0,82). The success of performing a throw in the lateral plane with the left hand, a parallel simultaneous throw of two clubs in the lateral plane and a throw of the other club from below with the right hand depends on the control over the relaxation of the biceps muscle of the right hand, in particular, at the moment of throwing the club, the muscles must be tense (0,82≥r≥0,87). These data are also confirmed by the relationship between the ability to control the movement of the hands, as well as maintain visual control (%) with the technique of performing asymmetric rotation of the clubs (r=-0,99). and a throw of the other club from below with the left club (r=0,98).

When performing throws with two clubs, both large and small, with incorrectly set kinematic parameters of movements in the starting phase of the throwing action, the gymnast's ability to change motor tasks when catching the clubs is of significant value (r=0,81). One of the conditions of technical work when performing a throw of opposite-handed clubs is a timely reaction to the catch of the second club performed by the non-dominant hand (r=-0,81).

Thus, the knowledge obtained made it possible to establish the conditions and tasks for the formation of skills in handling an object in rhythmic gymnastics in accordance with the coordination profile of exercises with clubs.

Conclusions. The conditions for developing skills in mastering the apparatus in rhythmic gymnastics exercises with clubs are a high level of development of coordination abilities in gymnasts already at the initial stage of sports training. The leading types of coor-

dination abilities for each type of technical elements with clubs were determined. Mathematical processing of the correlation analysis allowed us to define specific tasks for developing coordination abilities:

- to develop the ability of athletes to change the motor task under the condition of incorrectly specified parameters in the starting action of throwing clubs for an effective technique of performing a parallel simultaneous throw of two clubs in the lateral plane, throwing two clubs with a movement away from you, as well as throwing clubs of opposite names;

- to develop the ability of athletes to control the tension and relaxation of the biceps muscle of the arm when performing rotational manipulations with clubs (eights, club mills);

- to teach how to vary the height of the center of gravity of the clubs when reproducing rotational movements for mills; - to equip gymnasts with methodical techniques for developing the ability to regulate the direction of the fall of an object when implementing throwing actions with two clubs;

- to develop the tempo-rhythmic abilities of athletes, performing actions under a metronome to control the frequency and speed of throwing actions with clubs.

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A methodical approach to the pre-match training of goalkeepers in beach soccer

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Abstract

Objective of the study was to creation and validation of a holistic framework for the training of elite goalkeepers in beach soccer prior to competitions.

Methods and structure of the study. Analysis of special literature and documents; pedagogical observations; pedagogical testing; goniometry; psychophysiological diagnostics (simple visual-motor reaction (hereinafter SMVMR), reaction to a moving object (hereinafter RMO), discrimination reaction (hereinafter DR) and choice reaction (hereinafter CR)); modeling; pedagogical experiment; methods of mathematical statistics. The practical testing of the model of pre-competitive training of goalkeepers in beach soccer was carried out on the basis of two leading professional football clubs: PFC Kristall (St. Petersburg) and PFC Lokomotiv (Moscow). A comprehensive verification of the developed model was carried out with the participation of 24 highly qualified football players in the experiment.

Results and conclusions. The framework of the proposed model for pre-competitive goalkeeping training in beach soccer encompasses elements that consider: the temporal dimensions of implementation (spanning two to four weeks); the characteristics of specialized training (horizontal physical training, its individualization, including the biomechanical aspects of each player); the complexity of the training regimen; the adaptability to specific training loads; and the practical application. The overall proficiency of the goalkeeper is a crucial factor in the success of the entire team during the competitive period. The proposed model also takes into account the unique aspects of transferring various technical skills from football to beach soccer, as well as the implementation of these skills in the challenging environment of the sand court.

Keywords: *beach soccer, modeling, goalkeeper training, special training.*

Introduction. Significant differences in the athletic training of goalkeepers in classic and beach soccer draw attention to the urgent need to adapt the educational and training process to the specific requirements of the sport [6]. Among the current problematic topics of the modern development and formation of beach soccer is such a key aspect as the lack of methodological and statistical data on the training of goalkeepers. As a rule, outdated methods and methodological approaches are taken as a basis, which, according to formal characteristics, are means of influence transferred from other game sports without taking into account the specifics of the sand surface and the characteristics of physical activity during game activity [2]. One of the key factors influencing not only the increase in the level of physical fitness of football players, but also a significant reduction in the level of injuries during the competitive period, is the adaptation of football players to the sand surface and the performance of specific goalkeeper actions in difficult conditions, requiring long-term concentration in conditions of dynamically changing game situations [3]. Analytical work conducted by a number of authors (A.A. Roop, M.Yu. Nifontov, V.V. Ivanov) revealed a specific trend in beach soccer, which consists of significant changes in quantitative and qualitative characteristics in the first and third halves [4]. All of the above can serve

as a basis for confirming the fact that the traditional, existing system of sports training of goalkeepers in beach soccer does not provide a stable level of high reliability of the game throughout the entire competitive period. It is also worth noting the presence of a contradiction between the level of mental readiness in the competitive activity mode and a decrease in physical fitness by the end of the competitive period, as evidenced by the results of the psychophysiological diagnostics [5].

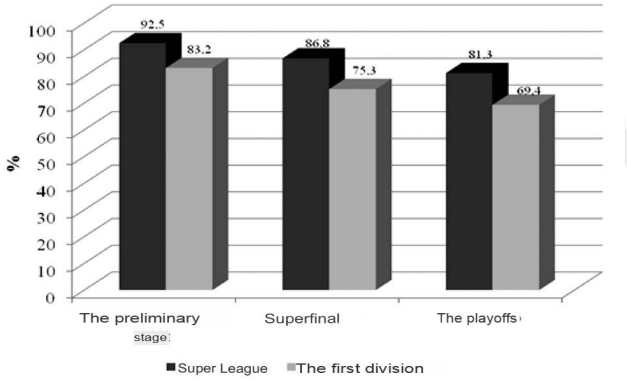
Objective of the study was to creation and validation of a holistic framework for the training of elite goalkeepers in beach soccer prior to competitions.

Methods and structure of the study. Analysis of specialized literature and other documents; pedagogical observations; pedagogical testing; goniometry; psychophysiological diagnostics (simple visual-motor reaction (hereinafter SVMR), reaction to a moving object (hereinafter RMO), discrimination reaction (hereinafter DR) and choice reaction (hereinafter CR)); modeling; pedagogical experiment; methods of mathematical statistics. Practical testing of the model of pre-competition training of goalkeepers in beach soccer was carried out on the basis of two leading professional football clubs: PFC Crystal (St. Petersburg) and PFC Lokomotiv (Moscow) in 2023-2024. A comprehensive test of the developed model was made possible by the participation of 24 highly qualified football players in the experiment. The reliability and representativeness of the sample of athletes in the pedagogical experiment was ensured by the fact that both football clubs are members of the top division of the Russian beach soccer championship. A serious visual factor for adjusting and improving the educational and training process in beach soccer, in general, and the process of sports training of goalkeepers, in particular, is a certain tendency towards a decrease in physical fitness indicators, the control of which was carried out using basic tests: such as 20 m run; long jump from a standing position; forward bend from a sitting position on the sand or standing on a gymnastic bench; Bangsbo sprint test, etc. The main decreasing indicators by the end of the competitive period are observed in speed-strength abilities, flexibility and special performance [1].

Results and conclusions. The effectiveness of the developed model of pre-competition training of goalkeepers was assessed based on the performance indicators of the ball, both in general and in terms of performing individual technical techniques - types of receiving the ball, parrying it, shots on goal, technical and tactical actions in defense, attack, etc. The results obtained during the testing of the developed model collectively form an indicator of the reliability of the goalkeeper's game in beach soccer.

The basis of the structure and content of pre-competition training of goalkeepers is a micro-cyclic approach, which is distinguished by its duration (from two to four weeks), an appropriate choice of physical activity and reflects a three-stage horizontal load balanced by types of load [3].

One of the indicators characterizing the specificity and reliability of the goalkeeper's game in beach soccer is a greater number of goals conceded in the first half and a smaller number of goals in the third half ($p < 0,05$). The figure shows the reliability coefficient of the goalkeepers' performance over a two-year period



(92,5% and 83,2%; 86,8% and 75,3%; 81.3% and 69,4% respectively) see figure.

Reliability coefficient of highly skilled goalkeepers (n=38)

Comparative analysis of psychophysiological abilities of goalkeepers in beach soccer showed maximum values in such indicators as SVMR, RMO, DR and CR at the end of the main competitive period. The level of attention has positive dynamics by the end of the period, which indicates the influence of the volume of competitive experience on this indicator. The effectiveness of the developed model for goalkeepers in beach soccer is confirmed by the data on the speed abilities of athletes in the experimental group - starting – 0,13 ± 0,05 and 0,22 ± 0,07 s; distance – 0,12 ± 0,04 and 0,29 ± 0,06 s. Separately, it is worth noting a reliable increase in the level of flexibility, speed-strength abilities and special performance in the experimental group (n = 12 people). Similar indicators in the control group (n = 12 people) are statistically insignificant (p> 0,05).

Conclusions. The overall high level of goalkeeper's sportsmanship is one of the basic moments of the entire team's performance in the competitive period. The presented model takes into account the specifics of positive transfers of various technical actions from the sport of «football», as well as its implementation in the complicated conditions of a specific surface. The conducted analysis of the game activity of goalkeepers in beach soccer showed a significant difference in the frequency of game actions performed with two hands 893,7±46,1, and a lower degree of performance of actions with two feet – 407,0±31,7 ($p<0,01$), as evidenced by the data on missed goals (124,8±10,0).

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Enhancing the speed and power of 14-17-year-old scuba divers through circular training

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Abstract

Objective of the study was to assess the extent of development of speed and strength in scuba divers aged 14 to 17, employing the circular training approach.

Methods and structure of the study. The research encompassed a cohort of young divers, aged between 14 and 17, who were divided into two groups: a control group and an experimental group, each consisting of 15 participants.

Results and conclusions. A contrast of the outcomes of the trials conducted on the experimental and control groups for the exercises under investigation reveals that in terms of speed and power, the experimental group demonstrated a substantial advantage over the control group. Additionally, the athletes in the experimental group achieved superior results at the conclusion of the athletic season in the sprint distances of 50 and 100 meters in flippers, compared to the athletes in the control group. This demonstrates the efficacy of the experimental program in enhancing speed and power abilities.

Keywords: *underwater swimmers, contests, circuit workouts, swiftness, physical prowess, power, athletic endurance.*

Introduction. Modern sports place increased demands on the physical fitness of athletes and underwater sports are no exception [1,2]. An important role is given to speed-strength training, which is understood as a set of means and methods for the comprehensive development of speed and strength in order to ensure comprehensive harmonious physical development, achieving the required level of special training of an athlete and, on this basis, achieving high sports results. Insufficient speed-strength qualities of athletes limits the effectiveness of performance in competitions. The absence of special speed-strength training in the training process of underwater swimmers in the proper volume leads to a decrease in the growth of functional qualities, and targeted work on the development of speed-strength qualities contributes to a uniform increase in the indicators characterizing this quality from age to age. Recently, when conducting classes, coaches have been using the circuit training method, which provides a comprehensive effect on various muscle groups. Circuit training, as an integral form of physical training, teaches students to think independently when developing motor skills, develops an algorithm of pre-planned motor actions, and fosters composure and organization when performing exercises [3].

Objective of the study was to assess the extent of development of speed and strength in scuba divers aged 14 to 17, employing the circular training approach.

Methods and structure of the study. The study involved juniors, underwater athletes aged 14 to 17 years (30 people), divided into experimental (A) and control (B) groups of 15 people each. During the sports season, the athletes of group A used the method of circuit training on land, which involves performing several exercises in a circle in a certain period of time with minimal rest. Various exercises for different muscle

Table 1. Average results of athletes from experimental group A and control group B at 50 and 100 meter finswimming distances

N of the test athlete (group A)	50 meters swimming with fins (group A)	100 meters swimming with fins (group A)	N of the test athlete (group B)	50 meters swimming with fins (group B)	100 meters swimming with fins (group B)
Girls	20,8	44,0	girls	22.0	49.2
Young men	19,5	40,2	young men	21.5	42,4

groups were selected for training (squats, push-ups, jumps, pull-ups, planks, etc.). Each exercise was performed for a certain time (for example, 30 seconds) or a certain number of times (for example, 10-15 times). The exercises were performed alternately - after completing one exercise, they immediately began another without a break.

Athletes of group B trained according to the traditional program. The following methods were used in the work: the method of assessing time indicators, the method of mathematical statistics. To assess the time indicators, the athletes studied were given the results shown during the season at distances of 50 meters swimming with fins and 100 meters swimming with fins.

Results of the study and discussion. Sports training is an important stage in preparing athletes for competitions. Speed-strength training is a set of means and methods for the comprehensive development of speed and strength in order to ensure comprehensive harmonious physical development, achieving the required level of special training of an athlete and, on this basis, achieving high results. In this work, the basis of speed-strength training will be various exercises. Only with a competent structure of the training process is it possible to show high sports results in competitions. In this study, we examined the best results in the season of athletes of group A and group B at distances of 50 and 100 meters swimming with fins. The results of the athletes are presented in Table 1.

Analyzing the results of the athletes in Table 1, we can say the following: athletes of group A have faster results in sprint distances of 50 and 100 meters than athletes of group B, both among girls and boys.

In order to determine the effectiveness of circuit training on land for the development of speed-strength abilities, athletes of group A and group B passed control standards on land. The results of the athletes are presented in Table 2.

Analyzing the results of passing the control standards of athletes in Table 2, we can say the following: athletes of the experimental group A, who used the circuit training method on land for a year, have better results than athletes of the control group B, both among girls and boys.

In order to determine to what extent underwater athletes need to use the circuit training method when training on land, we conducted a correlation analysis of the relationship between the sports result (the best result of the season at a distance of 50 and 100 meters) and the results of passing the control standards on land.

Analyzing the obtained results, we made the following conclusion: girls have a strong degree of dependence of the sports result at 50 and 100 meters (r = 0,83, r = 0,81) with the results of passing the control standards on land. Young men also have a strong relationship between the sports result at 50 and 100 meters (r = 0,85, r = 0,82) with the results of passing the control standards on land.

Conclusions. Comparison of the test results of the experimental and control groups for the tested exercises, presented in Table 2, shows that in speed-strength exercises the experimental group significantly surpassed the control group. Also, the athletes of the experimental group have higher results at the end of the sports season at sprint distances of 50 and 100 meters swimming with fins than the athletes of the con-

Table 2. Average results of passing control standards on land for athletes of experimental group A/control group B

Control standard on land / Athlete (group A/group B)	Jumping onto a bench from a full squat (in 20 seconds)	Shuttle run (4 x10 meters)	Bench jumps (20 seconds)	Squat push-up, lying push-up, squat push-up with jump (in 20 seconds)	Simultaneous lifting of straight legs and torso (for 20 seconds)
Girls	15/12	8,5/9,2	17/15	14/12	16/14
Young men	16/14	7,2/8,0	17/15	16/14	18/16

trol group. This indicates a greater effectiveness of the experimental program for the development of speed-strength qualities than the program that was used in the control group. The conducted correlation analysis of the relationship between the sports result (the best result in the season at a distance of 50 and 100 meters) and the results of passing the control standards on land showed a strong degree of dependence. This suggests that the use of the circuit training method on land in the preparation of 14-17 year old underwater swimmers has proven its effectiveness and can be recommended for wide use in practical work.

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Biomechanical characteristics of hammer throwing technique

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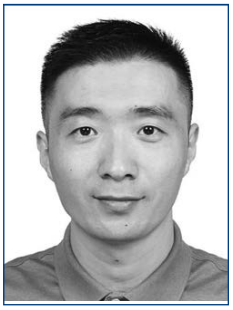

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Abstract

Objective of the study. To study the biomechanical characteristics of hammer throwing technique.

Methods and structure of the study. To determine the biomechanical characteristics of the hammer throwing technique, 3 attempts were made by all participants of the experiment with mandatory shooting by high-speed video cameras KASIO with a frequency of 120 frames per minute. The sample size of athletes of CG and EG was 10 observations for each investigated kinematic parameter. A total of 75 hammer throw attempts were recorded and 675 kinematic parameters were processed. We used APAS (Ariel Performance Analysis System) 3D video motion analysis system for video analysis and processing.

Results and conclusions. Comparing the relevant technical parameters with outstanding athletes in the world, it can be seen that the acceleration rhythm of Chinese hammer throwers in each lap fluctuates greatly during the rotation process, the center of gravity moves slowly and the acceleration time is especially inaccurate. At the same time, this is due to factors such as insufficient forward body inclination, right leg extension, little movement of the right foot on the ground, and slow landing speed. The rhythm of body rotation and the rhythm of hammertoe rotation were clearly raised, and it was pointed out that during single-supported rotation, the athlete increased the speed of the hammertoe end by increasing the angular velocity, while during the double-supported period, the speed of the hammertoe end was maintained by increasing the radius, thus achieving control of the equipment.

Keywords: *biomechanics, movement parameters, hammer throwing, movement technique, athletes.*

Introduction. An analysis of world record changes in the men's hammer throw shows a steady increase in performance from when the discipline was first introduced as an Olympic event in 1900 until the mid-1980s. In the late 1980s, Bartoniec [1] indicated that it was certain that the 90m mark would be surpassed in the men's sport. Although the years passed, the 1986 world record of 86.74m set by Yuri Sedykh still stands. Reasons for this lack of progress have been suggested to be that the current training models used by many coaches involve introducing strength training at a much younger age, which has led to less emphasis on skill acquisition [4].

In order for there to be further progress in sport, it is believed that coaches need to adopt a more critical, scientific approach to help with more accurate technical adjustments [3]. In addition, clearer guidelines need to be developed to optimize technique, without which hammer throwing can only be improved through trial and error [4].

Hammer throwing is a complex sport in which the laws of mechanics play an important role. Therefore, athletes and coaches must have a clear understanding of the laws underlying the sport to ensure technique improvement [5]. This chapter provides an overview of the biomechanical aspects of hammer throwing, firstly looking at the motion of the hammer projectile after release and then examining the kinematics and kinetics of the hammer, the thrower and the hammer thrower system.

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Methods and structure of the study. To determine the biomechanical characteristics of the hammer throwing technique, 3 attempts were made by all participants of the experiment with mandatory shooting by high-speed video cameras KASIO with a frequency of 120 frames per minute. The sample size of athletes of CG and EG was 10 observations for each investigated kinematic parameter. A total of 75 hammer throw attempts were recorded and 675 kinematic parameters were processed. We used APAS (Ariel Performance Analysis System) 3D video motion analysis system for video analysis and processing.

Results of the study and discussion. After the hammer is released, it performs a projectile motion on which two types of forces act on it: gravity and aerodynamic forces [2]. The gravity force acts vertically downward and its magnitude remains constant throughout the projectile motion, while the aerodynamic forces will vary depending on a number of factors. There are two aerodynamic forces acting on the hammer after release: drag force and lift force [2]. The magnitude and direction of the drag force (air resistance) will vary depending on environmental factors such as wind direction; however, in the absence of wind, this vector acts in the opposite direction to the hammer's linear velocity vector (opposite to the direction of throw). The lift force acting on the hammer is due to the Magnus effect and is considered negligible compared to other forces present [2].

The aerodynamics of an object is a measure of the maximum possible acceleration from aerodynamic forces during flight [3]. For a hammer, the aerodynamics is reported to be 0.74 m/s2, indicating that the assumption of zero drag is incorrect when estimating the range or throwing distance when throwing a hammer [3]. Hence, ignoring air resistance in range calculations will lead to an overestimation of the throwing distance [3].

Several studies have evaluated the effect of aerodynamic forces on hammer throwing distance. De Mestre [3] and Hubbard [4] derived two different analytical solutions to determine the effect of air resistance on range. Hubbard [4] reported that the inclusion of air resistance in the calculation resulted in an approximate 6% decrease in the range of a 7.26 kg hammer throw, while De Mestre's [3] analytical solution resulted in a range that was approximately 2% less. Neither of the results of these two models were compared with real throwing data.

If aerodynamic forces are ignored, aerodynamics is zero, which in turn causes the trajectory of the hammer to become parabolic [3]. Furthermore, the only force to be considered under these conditions is gravity; hence, the hammer experiences constant acceleration. For any projectile, the motion can be decomposed into horizontal and vertical components. Analysis of the equation describing horizontal displacement or range shows that the kinematic parameters at ejection that affect range in hammer throwing are the linear velocity of the hammer, the angle that the linear velocity vector forms with the horizontal, and the height at which the hammer is released above the ground [6].

Increasing the velocity and/or height of the throw will increase the throwing range. However, in order for the range to be as long as possible, throwers must ensure that all three throwing parameters are optimized. If an optimal value for each parameter exists, it can be determined by differentiating the equation for each parameter and setting the derivative equal to zero. Differentiating this equation by the ejection velocity and ejection height shows that there are no optimal values for these variables. This indicates that the linear velocity and height at ejection should be as large as possible [6]. This is not the case for ejection angle, which for a given velocity and altitude may have an optimal value that maximizes range [5].

If the projectile is fired from ground level, the range will be maximized if the angle of release is 45° [2]. However, if the projectile is released from a height that is higher than the landing height, as in the case of hammer throwing, the optimal release angle will always be less than 45°. Differentiating the equation with respect to the release angle and equating the derivative to zero, we obtain the following:

Using throwing velocities and throwing heights corresponding to hammer throwing shows that there is a small variation in the optimal throwing angle. The optimal angles fall in a narrow range between 44.15° and 44.56°. This is also evident when the optimal throwing angles are determined using the following simplified equation for range,

However, female throwers tend to have a flatter projectile ejection than males, which is likely due to an unfavorable relationship between projectile length and height.

Research suggests that throwers should ensure that the throwing height is as high as possible. However, the maximum throwing height achievable for a thrower is limited by anatomical constraints [1]. If the throwing height is too high, it can compromise

the thrower's ability to apply accelerating force to the hammer, which in turn can lead to a decrease in throwing velocity. In hammer throwing, the ideal throwing height is approximately shoulder height and to capitalize on this fact, hammer throwers should be tall. Less experienced throwers tend to release the hammer at a lower height [5].

Once the thrower has developed a technique that allows him or her to consistently achieve optimal throwing height and angle, it follows that the range can only be increased by increasing the throwing velocity, so it is imperative that the throwing velocity be as high as possible.

Two other kinematic parameters that must be considered when considering velocity development in hammer throwing are the radius of rotation and the angular velocity of the hammer. For a simplified model of a point mass (m) making a circular motion, the linear velocity (v) at any instant of time is equal to (v=r), where r is the radius of rotation (the distance between the point mass and the axis of rotation) and is the angular velocity of the point mass. This relationship implies that an increase in both the radius of rotation and angular velocity will result in an increase in the linear velocity of the rotating point mass. This confirms previous work that suggested that throwers should provide the largest possible radius of rotation, as this leads to an increase in hammer velocity [5]. A larger radius of rotation also results in a greater distance over which the hammer can be accelerated, but changing the radius of rotation will change the inertial drag of the hammer. For a point mass rotating at a distance r from the center of rotation, the magnitude of inertial drag/moment of inertia (I) at any instant of time is, I=mrr. From the equation, it is clear that increasing the radius of rotation will increase the inertial drag. An increase in inertial drag will in turn lead to a decrease in angular acceleration ( ) and hence angular velocity (assuming that the external torque ( ) applied to the mass remains constant). This is due to the following relationship,(= /I). Therefore, to maximize the linear velocity, the thrower needs to achieve an optimal relationship between angular velocity and radius of rotation that also minimizes the inertial drag of the hammer.

Having a larger radius in the initial parts of the throw has important consequences. For a given linear velocity, a larger radius allows the hammer-thrower system to rotate at a lower angular velocity. A lower rotational velocity allows the muscles involved to contract more slowly, allowing those muscles to exert greater forces. This is due to the force to velocity ratio for skeletal muscles. In turn, greater muscle force results in greater torque and an increase in the overall angular momentum of the system. Thus, the use of a larger radius in the early stages of the throw contributes to an increase in the angular momentum of the system [4].

As the throw progresses, the tendency to reduce the rotational radius leads to a decrease in the moment of inertia and an increase in angular acceleration. Thus, radius reduction, especially in the last part of the final turn, can be utilized by throwers to facilitate an increase in hammer velocity before release [3].

At any instant, the tether weight and force can be decomposed into three components: normal, radial, and tangential to the instantaneous circle of rotation [2, 6]. The normal components of the tether weight and force are equal and opposite and have no effect on the linear velocity of the hammer. The sum of the radial components determines the radial acceleration of the hammer head, which in turn determines the radius of curvature [6]. The only components that directly affect the instantaneous linear velocity of the hammer are the tangential components of the tether weight and force [4].

Researchers Isele R [4]., Nixdorf E. studied the hammer throw technique among the top eight men at the 2009 World Athletics Championships. They recorded hammer throw technique parameters using cameras and analyzed them using three-dimensional kinematic measurement techniques to obtain data and produce results. Parameters analyzed include:

- General parameters: hammer throwing velocity, hammer throwing angle, and hammer throwing height.
- Velocity parameters: the starting velocity of the first lap of the hammer and the value of velocity change in each lap.
- Time parameters: Single rest time, double rest time, sum of single and double rests.
- Path parameters: Length of the path traveled by the hammer in each lap, total path. The path corresponding to the single and double support stages of each lap.
- Angle parameters: azimuth angle, torsion angle.

It is concluded that achieving the maximum possible throwing distance in hammer throwing is primarily the result of creating the maximum possible throwing velocity and achieving the optimal throwing angle. The throwing height has little effect on the throwing distance. The fourth factor affecting the flight of any ob-

ject is air resistance, which cannot be affected by the thrower. In hammer throwing, the angle of release is achieved by practicing and gradually increasing the inclination of the initially flat trajectory of the hammer to a biomechanically optimal angle. Ballistically, the optimal release angle is 44°. However, this value is rarely achieved in hammer throwing, as a slightly more gentle release angle provides more favorable conditions for the leg, trunk, and arm muscles. In the current analysis, the average release angle for men was 41.3°. Our various analyses in recent years have shown similar results, with men achieving an average of 41.0° for throws over 77 meters.

Athletes need achievable guidelines for individual movement patterns to achieve a positive orientation in technical training. To meet this need, athletic trainers should consider the following basic technical requirements: 1. Shorten the duration of the single support phase by: a) leaning back in the first half of the double support phase, b) utilizing the back of the support, part of the double support phase. Perform a quick half rotation, c) turn the free leg close to the support leg, d) place the free leg behind the right side of the support leg. 2. Overcoming horizontal movement. Use the fourth lap to increase the dynamic parameters of the athlete and the hammer system,

At present, it is still difficult to obtain reliable kinematic and kinetic data in field/real competition conditions, resulting in a lack of real-time biomechanical feedback studies in sport domains.

Four factors can be considered influential, causal and interacting during hammer throwing and taken into account as a decisive factor affecting the thrower's technique:

a) The angle of the hammer at each turn.

b) The distance between the turn radius and the momentum at double support, estimated from the azimuthal angles of the hammer when the right foot comes off and resumes contact with the ground in each turn.

c) The behavior of hammer velocity, both horizontal and vertical, during the throw.

d) The angular momentum of the hammer through the vertical and horizontal axes.

In general, it can be said that, observing the data obtained by higher level throwers, the theory that the hammer can only accelerate during the double prop period, without the possibility of actively influencing its velocity during the single prop period, is only confirmed when the rotation around the vertical axis (horizontal velocity) is taken into account. In this sense, the angular momentum of the hammer generated through the vertical axis is in all cases greater during the double support phase than during the single support phase, which means that athletes develop more force during the double support phase and that the best throwers are those who reduce their angular momentum less during the single support phase.

Conclusion. Thus, comparing the relevant technical parameters with the outstanding athletes of the world, it can be seen that the acceleration rhythm of Chinese hammer throwers in each lap fluctuates greatly in the process of rotation, the center of gravity moves slowly and the acceleration time is especially inaccurate. At the same time, this is due to factors such as insufficient forward body inclination, right leg extension, little movement of the right foot on the ground, and slow landing speed. The issue of the rhythm of body rotation and the rhythm of hammertoe rotation was clearly raised, and it was pointed out that during single-supported rotation, the athlete increased the speed of the hammertoe end by increasing the angular velocity, and during the double-supported period, the speed of the hammertoe end was maintained by increasing the radius, thus achieving control of the equipment.

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Characteristics of the neurohormonal control of static muscle activity in children

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Abstract

Objective of the study was to investigate the reaction of the sympathetic-adrenal system to localized static strain in children with distinctive autonomic control.

Methods and structure of the study. The scientific work was attended by children aged 7 and 9 years of both sexes. The initial vegetative tone (IVT) was determined by the method of variational heart rate monitoring using the automated cardiopulmonological complex REACARD, on the basis of which the children were divided into groups – sympathotonics, normotonics, vagotonics. The urgent adaptation of the sympathoadrenal system (SAS) to static stress was studied by shifting the excretion of catecholamines (CA) and DOPA in urine portions in response to a dynamometric test.

Results and conclusions. Metered local static load in schoolchildren aged 7 and 9 causes changes in the functional state of the SAS, the nature of which depends on the IVT, age and gender of the children. In boys aged 7 years, sympatho- and vagotonic, isometric efforts are accompanied by unfavorable shifts, indicating the immaturity of the mechanisms of urgent adaptation of children of this age to static muscular activity. In 9-year-old boys, neurohumoral adaptive adjustments acquire a stable character, accompanied by positive, unidirectional shifts in the excretion of CA and DOPA in all IVT groups studied. Unlike girls, whose SAS reactions are more balanced at the age of 7, and at the age of 9 they are accompanied by a decrease in reserve capabilities, which is most pronounced in the state of sympathicotonia.

Keywords: *catecholamines, initial vegetative tone, local static load, schoolchildren aged 7, 9 years.*

Introduction. Educational activities, especially during the adaptation period, can have a negative impact on the child's body and, in particular, static loads that prevail in the daily life of a schoolchild. A special role in the neurohumoral regulation of the functions of the child's body, its adaptation to muscular activity is played by the sympathetic-adrenal system (SAS), which exerts its effect through catecholamines (CA) [1, 3]. It is known that the nervous and endocrine regulation of the functions of the child's body, its adaptation to physical activity is characterized by functional instability, manifested in physiological fluctuations in the production of hormones and mediators [4, 5]. At the same time, the issues of age-gender characteristics of the SAS response to static physical activity remain poorly understood. A comprehensive study of the functional state of the SAS and the features of the autonomic regulation of the heart rate in children with static muscular loads will allow us to record early shifts in the state of neurohumoral regulation of vegetative functions that precede pathological reactions of the body [2].

Objective of the study was to investigate the reaction of the sympathetic-adrenal system to localized static strain in children with distinctive autonomic control.

Methods and structure of the study. The scientific work involved 65 boys and girls aged 7 and 9 years, belonging to health groups I and II. The initial vegetative tone (IVT) was determined by the method of variation pulsometry using the automated cardiopulmonary complex REACARD, based on which the boys were divided into groups by IVT - sympathotonics, normotonics, vagotonics. The state of the SAS was assessed by the level of excretion of CA - adrenaline (A), noradrenaline (NA), dopamine (DA), DOPA in por-

tioned urine based on the fluorometric method using the BIAN-130 (M-800) device and CA standards from Sigma. The test with a local static load was carried out in a sitting position of the subject, by squeezing a hand dynamometer with the left hand with a force equal to 50% of the maximum voluntary force for 1 min. Urine collection was performed before the functional test and one hour after it.

Results of the study and discussion. It was found that in 7-year-old sympathotonic boys, against the background of relatively high pre-load values of NA excretion, in response to static effort there is a significant increase, which is 39,49% in relation to rest ($p < 0,05$), and the release of DOPA, the formation of which is a limiting link in the biosynthesis of CA, becomes 1,37% lower, that is, adaptive shifts in the SAS are accompanied by a decrease in its reserve capabilities (Figure 1). In boys in a state of vagotonia, static load is accompanied by a decrease in the reactivity of the SAS. Despite the lower background level of NA excretion, its values after the load in these schoolchildren have a negative trend, decreasing by 15,84% compared to rest, while DA excretion becomes 12,55% lower ($p < 0,05$). The release of A also decreases from 14,83±0,42 ng/min to 11,03±0,46 ng/min ($p<0,05$), only a compensatory increase in DOPA is noted, which, however, does not provide an adequate increase in the level of CA. Thus, the vagotonic variant of IVT in 7-year-old schoolchildren is accompanied by a relatively low activity of the SAS at rest and a decrease in its reserves after static effort, which may be a manifestation of fatigue and asthenia of the child's body during the period of adaptation to educational activities.

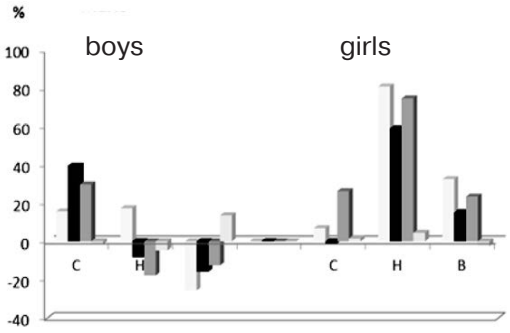

Figure 1. Changes in the excretion of catecholamines and DOPA in response to local static load in 7-year-old schoolchildren with different initial vegetative tone (%)

Note: S – sympathotonics, N – normotonics, V – vagotonics

A NA DA DOPA

It is noteworthy that in 9-year-old boys, the most adequate reactions of the SAS in response to isometric exercise were noted by us in the vagotonic group, where there is a simultaneous increase in the level of excretion of NA by 61,162% ($p<0,01$), DA and DOPA – by 22,52% ($p<0.05$) and 5,44%, indicating sufficient reserve capacity and economization of the SAS functions (Figure 2).

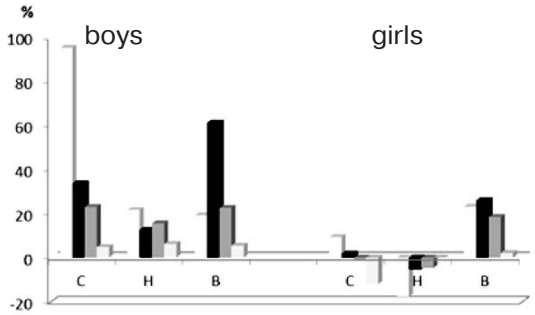

Figure 2. Changes in the excretion of catecholamines and DOPA in response to local static load in 9-year-old schoolchildren with different initial vegetative tone (%)

Note: S – sympathotonics, N – normotonics, V – vagotonics

A NA DA DOPA

In 7-year-old girls, compared to boys, the reaction of the SAS to a local static load is estimated by us as more favorable (Figure 1). In the state of sympathicotonia against the background of increased activity of the SAS at rest, a tendency to a decrease in the level of NA excretion after the load by 2,07% is noted, while the excretion of DA increases. In girls in a state of normotonia, a dosed static load causes the maximum increase in CA excretion compared to other studied groups – the excretion of A increases by 79,34%, NA – by 60,46%, DA – by 74,95%, and DOPA by 4,09%, which is manifested against the background of moderate activity of the SAS at rest and may indicate its sufficient functional and reserve capabilities. A different picture is observed in 9-year-old girls (Figure 2). In the group of schoolgirls with sympathico- and normotonic variants of IVT, a local static load causes no positive shift in NA excretion. The excretion of A changes similarly, its values become 1,59 ng/min and 0,64 ng/min lower than at rest ($p<0,05$). This is combined with a decrease or absence of a shift in the content of DA and DOPA - the excretion of DA decreases by 22,73 ng/min and 30,72 ng/min ($p<0,05$), while the excretion of DOPA does not change.

Conclusions. Dosed local static load in schoolchildren aged 7 and 9 causes changes in the functional state of the SAS, the nature of which depends on the IVT, age and gender of the children. In 7-year-old boys - sympatho- and vagotonics, isometric efforts are accompanied by unfavorable shifts, indicating the immaturity of the mechanisms of urgent adaptation of children of this age to static muscle activity. In 9-year-old boys, neurohumoral adaptive changes acquire a stable character, accompanied by positive, unidirectional shifts in the excretion of CA and DOPA in all studied IVT groups. In contrast to girls, in whom at 7 years old the SAS reactions are more balanced, and at 9 years old they are accompanied by a decrease in reserve capabilities, which is most clearly expressed in the state of sympathicotonia. Thus, the obtained results indicate the need to dose static physical loads for children aged 7 and 9 years, taking into account their age, gender and the state of the autonomic nervous system.

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Assessment of the impact of implementing a personalized learning path for student athletes in the sport of skiing

UDC 796.011.3

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Abstract

Objective of the study was to evaluation of the success of the personalized educational path for student-athletes in the field of skiing.

Methods and structure of the study. The educational research encompassed a group of 15 students-athletes pursuing their studies in the second year of the program 49.03.01 «Physical Education» at the university.

For these students, an individualized learning path in the subject of Skiing was created in the form of an online course, which included essential theoretical content, including instructional videos, as well as specially designed tasks to assess their proficiency in the subject.

The academic performance of the students during their study of the subject «Skiing» in the 2023-2024 academic year was analyzed as part of their individualized learning path. Additionally, upon completion of the subject, they were requested to fill out a survey in the form of a questionnaire to evaluate their satisfaction with the organization of their training.

Results and conclusions. The findings of the research indicate that over 60% of student athletes have successfully completed the course in skiing and are content with the organization and content of the training program, which suggests the successful implementation of the individual educational path for students involved in sports.

Keywords: *personalized learning path, student-athletes, Skiing specialty, contentment.*

Introduction. Student-athletes, for whom sports activities are the main type of activity, find it difficult to demonstrate academic success, since they are constantly at training camps or competitions. Absences from classes entail debts in disciplines, which can lead to academic leave or expulsion [2]. One of the ways to solve the problem of academic performance of student-athletes is to create an individual educational trajectory for them, which includes methodological support for educational and independent activities, specially developed assessment tools, as well as a personal schedule of training and passing midterm assessment. A distinctive feature of the individual educational trajectory is its implementation in a digital environment, which allows student-athletes to master disciplines regardless of their location [1].

Objective of the study was to evaluation of the success of the personalized educational path for student-athletes in the field of skiing.

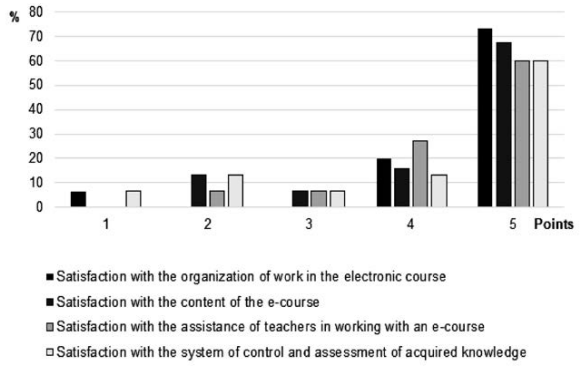
Methods and structure of the study. The study involved 15 second-year student-athletes studying in the 49.03.01 Physical Education program. Their academic performance in the Skiing course in the 2023-2024 academic year was analyzed as part of an individual educational trajectory. Also, upon completion of the course, they were asked to complete a survey in the form of a questionnaire to assess their satisfaction with the organization of training. An individual educational trajectory for the Skiing course was developed for student-athletes. The Skiing course lasts two semesters, and a grade (exam) is given upon completion of the course. Students were trained in the form of an e-course, which was filled with the necessary theoretical material, including educational videos, as well as specially designed assignments to assess their mastery of the course. An individual track for completing the course was organized for each student-athlete, regulating the time for com-

pleting assignments, as well as a personal version of assignments.

In total, students were offered 8 complex tasks (one task for each topic), which were cases on designing a lesson, training session, competition using graphic techniques (mind map, denotational graph) and digital tools (video, etc.).

Results of the study and discussion. The analysis of the academic performance of student-athletes (at the beginning of the midterm assessment) in the discipline «Skiing» within the framework of training on an individual educational trajectory showed that nine of them completely completed the electronic course and successfully completed all the tasks, four students completed more than 50% of the tasks, but not enough for this result to be credited to them as successful mastery of the discipline. Two students completed the course by less than 25% and one student did not start studying the discipline at all.

Then the students were asked to answer questions of a questionnaire aimed at identifying satisfaction with the conditions of the organization and content of the educational process in the discipline «Skiing». The questionnaire included 8 main questions related to the organization of training within the framework of an individual educational trajectory, the content of theoretical material and tasks in the electronic course, the system of monitoring and assessing the knowledge gained, as well as an assessment of the teacher's assistance in working with the electronic course. A satisfaction assessment scale from 1 to 5 was proposed, where 1 is not at all satisfied, and 5 is completely satisfied. The figure shows the distribution of responses to some questions in the questionnaire.



Distribution of responses of student-athletes on satisfaction with the conditions of the organization and content of the educational process in the discipline «Skiing»

As can be seen from the figure, most of the student-athletes were satisfied with the conditions of the organization and content of the educational process in the discipline «Skiing». Also, student-athletes were asked to assess the degree of mastering the material in the discipline "Skiing" on a scale from 1 to 5, where 1 means not mastered at all, 5 means completely mastered. 9 students stated that they completely mastered the discipline (these are the 9 students who completely completed the training in the e-course). Two students each chose the answer well and satisfactorily mastered, and one student each answered that they practically did not master and did not master at all. This indicates that about 60% successfully mastered the discipline «Skiing».

Conclusions. The study revealed that more than 60% of student-athletes were satisfied with the conditions of the organization and content of the educational process within the framework of the individual educational trajectory in the discipline «Skiing». More than half (nine people) of the students who participated in the study successfully completed the training within the e-course, having completed all the tasks. The same nine student-athletes assessed their level of mastering the material in the discipline as «completely mastered», which also indicates the successful implementation of the individual learning trajectory in the educational process of students.

Thus, based on the above data, it can be argued that the use of the individual educational trajectory in the discipline «Skiing» was effective.

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Enhancing the professional development of adapted physical education teachers in Russia and Serbia: challenges and best practice

UDC 376

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Abstract

Objective of the study is to conduct a comparative analysis of training and professional development programs for teachers of adapted physical education in Russia and Serbia to identify similarities and differences between the two systems, which operate in accordance with their national regulations.

Methods and structure of the study. This paper examines the current legal framework governing teachers' professional development, along with the procedures and regulations that shape this process within the educational systems of Russia and Serbia. By analyzing theoretical frameworks and existing training programs, it provides insights into the extent to which teacher development supports the successful implementation of educational reforms, according to modern challenges and trends.

Results and conclusions. Research has shown that the regulations introduced in Russia and the Republic of Serbia over the past decade have significantly increased awareness of the importance of professional development for teachers in the field of adapted physical education. The available programs have the potential to encourage greater teacher participation in this specialized area of physical education. There are a lot of similarities in the systems of professional development of adaptive physical education teachers in Russia and Serbia, but there are also significant differences. Among even models of professional development and advanced training that are similar in form, there are their own specifics and some differences in relation to: the mandatory nature of professional development, time of retraining and advanced training (working, non-working), the number of mandatory hours (from 15 to 166 hours), frequency (from once every 5 years to annual training), the degree of centralization of advanced training management - centralized and decentralized, etc.

Keywords: *teachers, continuous professional development (CPD), Adapted Physical Education (APE), comparative analysis*

Introduction. Modern trends in the development of education and the challenges, associated with them, determine the appeal to the problem of professional development of teachers in Russia and abroad as a response to the growing requirements of society for the personality of a teacher and his/her activities in the context of globalization and internationalization of education [3, 7, 12].

Teacher professional development is essential for the continuous modernization of the educational process, whether in secondary, upper-secondary or professional education. Acquiring additional qualifications and enhancing teachers' competencies in today's challenging environment require the continuous monitoring of achievements in both theoretical and practical aspects. Multiple researches indicate that professional development can sustainably enhance the quality of teaching and learning, improve the efficiency of education and training, and provide added value for students, teachers, and employers [8, 13].

Professional development takes place through direct work, practical teaching experience, and participation in training programs. Therefore, the professional development of teachers and trainers is essential for implementing educational reforms and improving overall education quality.

Theoretical and practice-oriented analysis of the problem of professional development of specialists working with students with special educational needs is an urgent problem and requires the fundamental research of this problem from the point of view of updating pedagogical knowledge and pedagogical practice.

Since 2018, the Russian Federation has been implementing the Decade of Childhood program, aimed at increasing the attention of the state, research teams and the public to address the most pressing issues in the life and health of children. The section «Comprehensive development, education and upbringing of children» of the plan of main activities, carried out under this program for the period up to 2027, includes measures to identify and state support for gifted children, including children with disabilities and disabled children, orphans and children left without parental care [3]. Professional standards have been introduced that establish qualification requirements for specialists working with disabled children and children with disabilities (teachers/educators, psychologist teachers, tutors). Pedagogical workers, along with secondary or higher professional pedagogical education in the relevant position of training, must have appropriate competencies in the field of education and upbringing of children with special education needs [3, 11].

So, the challenges posed to teacher education in the field of adapted physical education require high professional skill and competence of teaching staff, and successful practices of organizing the professional development of a teacher abroad have adaptation potential and can serve as a resource for Russian professional education reformers in the context of the state educational strategy.

All these facts clearly testify to the importance of the problem of professional development of teachers, working with disabled children, and the value of using the best international practices in this area. The Republic of Serbia, as a friendly country to Russia, provides rich experience in teachers' professional development, and is ready to share it with the Russian colleagues.

This paper particularly emphasizes the available programs for professional development of teachers of adapted physical education in Russia and Serbia, as well as initiatives undertaken by relevant institutions to encourage greater participation in these programs.

Objective of the study is the comparative analyses of the functioning of the professional development system of teachers in the field of adaptive physical culture in Russia and in Serbia, and it is caused not only by the friendly attitude of this country towards the Russian Federation, but also by the fact that Serbia has a rich constructive experience in this area, which can be used in Russian universities that train specialists in this area.

Methods and structure of the study. A set of approaches was used, including competence, system, axiological, and comparative approaches. The research materials also included the authors' early scientific research: the development of a modern paradigm of professional development of teachers in universities and a comparative analysis of international projects to support the professional growth of higher education teachers, which are the basis for organizing a system of professional development of adaptive physical education teachers in a university and determining its current content. Theoretical methods were used: system and comparative analysis and generalization; empirical methods include «participant» observation, conversations, questionnaires, and interviews.

Results of the study and discussion. The professional development of teachers in Russia and Serbia, including those in the field of adapted physical education, is governed by the Russian Law Of Education (2012) and the Serbian Law on the Fundamentals of the Education System (2017). Special Articles of these Laws require teachers, educators, and professional associates to engage in continuous professional development to enhance their competencies, improve work quality, and achieve educational goals and standards of academic achievement. The policy of continuous professional development (CPD) for teachers is reinforced by the Decree of the President of the Russian Federation of 07.05.2024 No. 309 "On the national development goals of the Russian Federation for the period up to 2030 and for the future until 2036". In Serbia, the same key strategic goals were declared in 2021 in the National Strategy of Education Development in the Republic of Serbia until 2030. The Law on the Fundamentals of the Education System (2017) explicitly states that only individuals holding a work permit, i.e., a license issued by the Ministry of Education of the Republic of Serbia, can serve as teachers. The procedures governing teachers' pro-

Table 1 - Overview of available CPD programs in APE [15-16]

Program title	Program organizer	Fundamental goal
"Movement and Physical Activity as Key Drivers of Developmental Processes in Children with Developmental Disabilities – A Modern Approach"	Serbian Association of Physical Education and Sports Teachers	Focusing on contemporary methods for working with children with special needs
"Directions for the Development of Inclusion in Physical and Health Education"	Singidunum University	Exploring inclusive teaching methods in physical education
"Step to Health – Corrective Gymnastics"	Regional Center for Professional Development of Education Employees	Incorporating corrective exercises to enhance students' motor abilities
"Application of ICT in Teaching Physical and Health Education"	Association of Physical Education Teachers	Training teachers to integrate information and communication technologies into physical education
"Application of IEP in Outcome-Oriented Physical and Health Education Teaching"	Faculty of Sports, University "Union-Nikola Tesla"	Strengthening teachers' competencies in planning and designing lessons for students with disabilities and developmental challenges

fessional development are defined in the Rulebook on Continuous Professional Development (2021), which specifies details regarding training programs, priority areas, and the accreditation process [5].

One of the most important objectives in both documents is the establishment of a system for professional and pedagogical training of teachers, the development of Centers for enhancing teaching competencies and skills, and the provision of training to improve personal capabilities [10]. Together, these documents establish the legal framework for the continuous professional development of teachers in Serbia and in Russian Federation.

As for the structure of the teachers' professional development system in the field of adapted physical education in Russia and Serbia, it is organized quite diverse - each educational organization acts in this matter in accordance with its own strategies and traditions. The most popular is the functioning of the continuing education system on the basis of the educational organizations themselves.

Let us point out that often, among models of professional development and advanced training, that are similar in form, there are their own specifics and significant differences in relation to the mandatory nature of professional development, time of retraining and advanced training (working, non-working), number of mandatory hours (from 15 to 166 hours), frequency (from once every 5 years to annual training), the degree of centralization of advanced training management - centralized and decentralized. For example, the professional development of teachers in Russia is carried out without the intervention of federal educational authorities, while in Serbia, on the contrary, the professional development of teachers is under state control.

In Russia and Serbia, teachers' professional development in adaptive physical education is offered through various programs conducted by educational institutions. In this article, we are going to present some good practices, provided by the Institute for the Improvement of Education in Serbia [16], and the Volga Region State University of Physical Culture, Sport and Tourism (VRSUPhCS&T), Kazan, Russia. These programs cover key topics, including:

- Lesson Planning and Implementation: Educators enhance their competences to adapt teaching methods and activities to accommodate students with diverse needs.
- Inclusive Education: Training emphasizes the development of skills necessary for teaching in inclusive classrooms, with a focus on integrating students with disabilities.
- Use of Specialized Equipment: Teachers receive instruction on utilizing tools and equipment that facilitate adaptive physical activities.
- Interdisciplinary Skills: Programs explore connections between physical education, health, and social development.

The training and re-training of teachers in adaptive physical education through accredited programs is a significant aspect of professional development in Serbia. There are 30 accredited professional development programs in the field of physical education, a few specifically focus on adaptive physical education. According to the catalog of the Institute for the Improvement of Education, Table 1 represents the most notable programs.

These programs are in great demand for teachers in adaptive physical education, and, at the same time, it is evident that the offerings are highly limited compared to the actual need in this field. Expanding the number of such programs aligns with the growing significance of inclusive education and its role in modern teaching.

In the Volga Region State University of Physical Culture, Sport and Tourism (Kazan, Tatarstan Republic), the Department of Adaptive Physical Education and Life Safety (Chairperson – associate professor L.A.Parfenova) trains highly qualified specialists to work with a contingent of individuals assigned to special medical groups in educational institutions of all types and kinds, including in special educational institutions (auxiliary schools and preschool institutions, boarding schools for children with developmental defects, leveling classes, orphanages, neuropsychiatric dispensaries, correctional education classes, etc.). An integral component of training at the department is its practical orientation. Starting from the first year, students practice in various state and non-state institutions. The training is conducted by a team of high-class professionals who are involved in the system of continues professional development (CPD). The Volga region State University pays special attention to the enhancing the professional development of adapted physical education teachers, and it is worth mentioning that the university has a fairly effective system of professional development of teachers, the main valuable initiatives and supporting activities of which are [6, 12]:

- organization and support of motivational environment for the teaching staff;
- development of start-ups for teachers aimed at formation of intellectual capital of the university;
- stimulating creativity and retaining «young talents» in adaptive physical education at the university;
- ensuring the independence, initiative, self-organization of young teachers in adaptive physical education;
- material remuneration of talented and effective teachers;
- availability of educational «platforms» where the teacher can receive support and assistance in professional development;
- high degree of integration of teaching with research as a tool for CPD;
- actual and «virtual» scientific and educational internships;
- mentoring and training in up-to-date MOOC courses;
- promotion of participation in «winter» and «summer» Schools of pedagogical mastery, etc.

There is no doubt that adaptive physical education increasingly needs «new» teachers who can easily reconfigure their teaching, who can establish contact with any audience of students, regardless of the level of its «digital gap» who own multimedia technologies (video lessons, tutorials, interactive platforms) and are fully «integrated» into the global network. In this regard, today educational organizations in Russia and Serbia organize retraining and professional development programs for teachers in the most attractive areas of professional improvement, adaptive physical education is among them. In fact, a total system of «re-education of educators» is being deployed, which contributes to the growth of human capital of the educational organization. The CPD system is provided by the Centers for Teaching Methods, Centers for Technical Support of Education, Centers for Improvement and Professional Development created at universities and supported by universities in both countries.

Furthermore, the comparative analysis shows that the current stage of development of the system of teachers' professional development in Russian and Serbia is characterized, first of all, by a rethinking of key values in the essential-content characteristics and technologies for improving professional skills and professional retraining of teachers [9, 14]. The «new» teacher of adaptive physical culture is characterized by the properties of high potential for research and professionalism, pedagogical reflection and pedagogical leadership, mastering new professional roles in his/her development:

- from the knowledge consumer - to their generator and production;
- from the use prescribed - for the design of the new;
- from a responding performer - to a socially responsible representative of the pedagogical profession, a reflexopractor-professional;
- from the performance of professional pedagogical duties - to work in a team through cooperation;
- from designing only their own actions - to complicity in the development of an educational organization, etc.

In modern conditions, the teacher of adaptive physical culture also acquires and successfully implements new roles, such as «integrator of various multimedia tools, programs and resources», «developer of complex educational scenarios», «student» etc. [1, 9, 12]. At the same time, a large number of innovative specialists also appear on the modern educational labor market, working in on-line training formats and designed to ensure the success of the professional development of teachers. Among them:

- a developer - a methodologist-developer who creates educational content to fill an electronic training resource, regularly updates the content of the online platform, and also advises teachers who use web resources in the learning process;

- a tutor – a network teacher-mentor (curator, consultant, instructor), who simulates pedagogical interaction in a digital educational environment, studying according to an individual educational program;

- a facilitator - a teacher-coordinator whose main task is to organize networking of students in the format of audio and video conferencing;

- an invigilator - a specialist in monitoring the results of development in a digital educational environment, etc. [11, 15].

Indeed, comparative research on the international experience of teachers' professional development in adaptive physical education can be very valuable and in demand if it is considered from a critical perspective and in terms of potentially useful information for Russian system of education.

Conclusions. The analysis of documents defining national and global prospects for improving the process of professional development of teachers in Russia and Serbia made it possible to find and substantiate those general constants and basic characteristics that determine the professional development of teachers as scientific knowledge, as a process, and as a social value.

The comparative analysis found that it is advisable to include the following characteristics of the Serbian system of teachers' professional development in adaptive physical education into the Russian one:

- multi-model and multi-variability of the professional development system;

- diversification of formats, structures and programs of the CPD system; replacing the traditional model with non-linear (asynchronous) models;

- approval of paradigms of personality-oriented development and the use of modular competence technologies as a new organizational framework for the professional development of teachers;

- internationalization of the system of professional development of teachers;

- development of social partnership and dialogue between the subjects of the professional development of teachers, etc.

To a certain extent, these characteristics can be also attributed to the Russian systems of professional development, adding the following essential features:

- strengthening the professionalization of the process of professional development of teachers, namely: updating the need for quality control and professional certificates, their recognition; closer connection with research activities; the increasing need for educational programs for professional development in adaptive physical education, etc.;

- expanding sources for grants and scholarships to support the CPD of teachers in adaptive physical education;

- increased competition in the international and national markets of educational services to improve the professional skills of teachers, etc.

In conclusion, we point out that in the era of digitalization of education, the growing role of professional development of teachers is becoming global, where innovative experience, support for the interaction of successful pedagogical practices, dissemination of initiatives and innovations of teachers, and strengthening the personality-oriented orientation of professional development system are becoming in great demand.

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The formation of professional and ethical competencies among future specialists in the field of physical culture and sports

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Abstract

Objective of the study was to validate empirically the educational requirements for the development of professional and moral competencies in students at the University of Physical Education.

Methods and structure of the study. The approach of theoretical examination and synthesis of scholarly publications, pedagogical insights, student surveys, expert evaluation, pedagogical experimentation, and statistical analysis (Mann-Whitney U-test) was employed. The verification of the study's working hypothesis was conducted through experimental work as part of the students' coursework in the subject «Professional Ethics».

Results and conclusions. The findings of the research, which involved 234 first-year students at the University of Physical Culture, suggest that the majority of participants recognize the significance of ethical principles in human life and work. However, approximately half of the respondents would not rely on these principles when faced with moral dilemmas. The study has identified and experimentally validated the pedagogical factors that contribute to the development of professional and ethical competence among future professionals in the field of physical culture and sports.

Keywords: *professional and ethical competence, students of the University of Physical Education, educational process, formation of ethical knowledge, skills, personal qualities.*

Introduction. Professional development of a specialist in modern conditions is determined by the demands of the labor market, the realities of the time, and the demand for the competencies being developed. Therefore, the formation of relevant competencies in a future specialist, necessary for the performance of labor functions, is of great importance. In accordance with the requirements of the Federal State Educational Standard of Higher Education in the areas of training 49.03.04 – «Sport», 49.03.01 – «Physical Education», professional standards «Trainer-teacher», «Specialist in instructor and methodological work in the field of physical education and sports», students must be ready to perform the tasks of professional activity and, in the process of studying at a physical education university, master the skills of «monitoring the observance of the rules of ethical behavior by those involved»1, observe ethical standards in the process of communication. Within the framework of professional training, it is no less important to resolve issues of personal development (self-development) of students, the formation (self-education) of their professional and ethical qualities, spiritual and moral values. This determines the formation of professional and ethical competence in future specialists in physical education and sports, which presupposes their mastery of knowledge in the field of pedagogical and sports ethics, readiness to implement them in the professional sphere.

[1] Professionalnyy standart «Spetsialist po instruktorskoy i metodicheskoy rabote v oblasti fizicheskoy kultury i sporta» (Zaregistrirovano v Minyuste Rossii 27.05.2022 N 68615): utv. Prikaz Mintruda Rossii ot 21.04.2022 N 237n). Available at: https://fgosvo.ru/uploadfiles//profstandart/05.005.pdf (date of access: 15.09.24).

Methods and structure of the study. In order to experimentally test the pedagogical conditions for the formation of professional and ethical competence in students – future specialists in physical education and sports, the following research methods were used: theoretical analysis and generalization of scientific and pedagogical literature; pedagogical observations; questionnaire survey of first-year students (n=234); expert assessment method; pedagogical experiment (n=30); methods of mathematical statistics (Mann–Whitney U-test).

Results of the study and discussion. Professional and ethical competence occupies an important place in the system of professional training of a specialist in physical education and sports; it ensures readiness for ethically adequate behavior in situations of moral choice. As L.B. Filatova asserts, «the most important system-forming principle of professional training of a specialist is the moral and ethical imperative, which allows concentrating the spiritual and physical strength, abilities and opportunities of the future specialist on achieving the heights of professional mastery and revealing his human essence» [4, 7 p.].

Professional and ethical competence is understood as «individual psychological education formed in the process of professional training and including the formation of a system of special professional competencies that allow a graduate to successfully perform functional duties, assess the level of responsibility for the results of his activities from the standpoint of ethics and moral values, including in situations of moral choice» [2, p. 9].

The components of professional and ethical competence are: motivational, which implies awareness by future specialists of the importance of observing ethical and moral standards in the process of professional activity, motivation to comply with them; cognitive, aimed at forming the moral consciousness of students through a system of ethical knowledge; an activity component, which implies the implementation of moral standards when performing various types of activities; a personal component, which is associated with the formation of professional and ethical qualities in students [1].

The formation of professional and ethical competence in future specialists will be more effective if the following pedagogical conditions are created within the educational process: - formation of motives for appropriate behavior in the process of performing various types of professional activity; students' understanding of the importance of mastering a system of ethical knowledge and the ability to use it in their activities; updating the educational and methodological support of the educational process in the direction of the ethical component; development of methods, techniques, means, and forms of organizing training that ensure students' mastery of ethical knowledge and skills as components of professional and ethical competence; development and completion by students of competency-oriented assignments that require the application of ethical knowledge and the demonstration of a number of ethical qualities; inclusion of students in professionally-oriented, educational and research activities; ensuring the opportunity for professional self-development and self-realization [2, 3].

The results of a survey of 234 first-year students conducted in the fall of 2024 using the Simpoll digital tool show that the majority (75%) of them understand the importance of ethical and moral standards, but almost half (47%) of the surveyed students would neglect them in order to achieve success. 67% of first-year students believe that moral standards change over time. First-year students rated their level of moral education highly – 8,13 points on a 10-point scale. At the same time, as the results of pedagogical observations of the behavior and activities of these students in classes show, many of them violate disciplinary standards in the process of informal communication: they are often late for classes, do not always treat each other and teachers with respect, do not always responsibly approach the completion of teacher's educational assignments, do not submit them on time, etc. In order to test the effectiveness of theoretically substantiated conditions for the formation of professional and ethical competence, a pedagogical experiment was conducted at the Department of Pedagogy of NSU im. P.F. Lesgaft, St. Petersburg in the process of teaching 4th-year full-time students the discipline «Professional Ethics» [3]. The effectiveness of the experimental work was determined by the following indicators:

1. The degree of formation of ethical knowledge (assessed using test assignments and written work).

2. The degree of formation of professional-ethical skills (listening without interrupting; hearing the interlocutor; correctly defending one's point of view; finding a compromise in controversial issues, observing ethical standards) was determined using expert assessment.

3. The degree of manifestation of such professional-ethical qualities in students as restraint, responsibility, integrity in solving competence-oriented tasks within the framework of group and micro-group work was checked using expert assessment (teachers of the Department of Pedagogy, a researcher, and the head of the study group acted as experts).

The results of the pedagogical experiment show that the level of ethical knowledge of students in the experimental group increased from above average to high, the level of professional and ethical skills from average to above average, the level of manifestation of professional and ethical qualities from average to above average. The reliability of differences in the studied indicators according to the Mann-Whitney U-criterion in the control and experimental groups was recorded at the significance level of $p < 0,05$.

The formation of professional and ethical competence is also carried out in the process of teaching students other pedagogical disciplines («Pedagogy», «Pedagogy of Physical Education and Sports», «Scientific and Methodological Activity», Master's degree disciplines) through all components of the educational process.

For example, in the process of solving professionally oriented problems related, among other things, to the development of educational and methodological materials with ethical issues; implementation of project activities; conducting business games, various forms of group work; organizing discussions, problem seminars on moral issues; solving pedagogical situations (cases) with a moral component; organization of scientific research activities based on compliance with the ethics of scientific research, etc.

In this regard, it is important to organize interpersonal interaction between subjects of the educational process, which contributes to the mastery of students of humanistic-oriented methods of pedagogical communication and adequate selection and implementation of humanistic-oriented pedagogical tools. The effectiveness of the educational process is diagnosed in the process of pedagogical practice, which allows the formation of professional competence.

Thus, in the process of studying the discipline «Scientific and methodological activity», students acquire the knowledge and skills necessary for formulating a methodological apparatus for research, designing the logic of scientific research, structural design of various types of scientific research, etc. At the same time, attention is focused on the problem of ethics of scientific research, its basic requirements and rules for implementation. Consideration of this ethical situation using the example of scientific research gives students an understanding of not only how the research is carried out, but also an understanding of the ethical problem associated with the manifestation of respect, depending on specific actions and behavior.

Conclusions. Thus, the formation of professional and ethical competence of future specialists in physical education and sports is determined by the effective design of all components of the educational process, taking into account the moral component and experimentally substantiated pedagogical conditions that ensure students' understanding of the importance of ethical and moral standards, the formation of motives for appropriate behavior, and the acquisition by students of ethical knowledge, skills, and personal qualities.

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Digital transformation of physical education: the experience of creating an environment in the system of training specialists in physical education and sports

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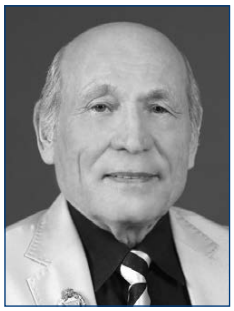

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Abstract

The purpose of the study is to generalize the experience of forming a digital educational environment for training specialists in physical culture and sports in the context of digital transformation of education on the example of Udmurt State University.

Methodology and organization of research. The following methods were used to prepare the article: analysis and generalization of scientific and methodological literature on issues related to the digital transformation of education in general and physical culture education in particular, a retrospective analysis of the formation and formation of the digital educational environment in the system of training specialists in physical culture and sports based on the authors ' experience.

Research results and conclusions. The article reveals the features of the formation of the digital educational environment in the context of the digital transformation of physical culture education, the problems associated with the digital transformation of physical culture education and the formation of the digital educational environment, taking into account the transition to a new system of higher education, the development of new sports, the features of the training direction "Physical Culture", относящегеrelated to practice-orientedму, the need формированиято both students and teachers should develop digital competencies necessary for training personnel for the digital economy. The analysis of the obtained results will make it possible to purposefully improve the digital educational environment in the system of training specialists in physical culture and sports in the areas of organizing the educational process, scientific activities, educational work, in the direction of administrative management and strengthening the material and technical base of the university, taking into account the development of modern digital technologies.

Keywords: *digital educational environment, digital transformation of physicalго culture educationя, training of specialists.*

Introduction. At the present stage, our country is actively implementing initiatives for the digital transformation of key sectors, including the economy, industry, social sphere, education, healthcare, as well as physical culture and sports. The key points in this process were the approval of the national program " Digital Economy "and the adoption of the document"Strategy for the development of the Information Society in the Russian Federation for the period 2017-2030". In the context of the implementation of the latter, the National Project "Education" was formed, an integral part of which was the federal project "Digital Educational Environment" (DSP). This initiative is aimed at creating an innovative and secure digital educational ecosystem that guarantees the availability and high level of educational services of all types and stages. The implementation of this idea implies the creation of an appropriate technological foundation both within the framework of the national educational system and in relation to specific areas of professional training.

The purpose of the study is to generalize the experience of forming a digital educational environment for training specialists in physical culture and sports in the context of digital transformation of education on the example of Udmurt State University.

Methods and structure of the study. In preparing this work, the following research approaches were applied: a comprehensive review and synthesis of scientific and methodological sources covering the problems of digital transformation of the educational sphere in general and physical culture education in

particular. In addition, a detailed retrospective analysis of the processes of the emergence and evolution of the digital educational ecosystem in the context of training professionals in the field of physical culture and sports was conducted, based on many years of practical experience of the authors of the study.

Research results and their discussion. As the analysis of scientific and methodological literature has shown, many researchers have turned to the study of the concepts of "Digital transformation of education" and "Digital educational environment" [6, 10, 13].

In our opinion, the digital transformation of education, including in the field of physical culture, implies a fundamental rethinking of the educational process. This processincludesючает the development and implementation of digital educational resources – a new generation of didactic materials operating within the digital educational environment. This environment covers a wide range of components: 1) technological infrastructure (computers, tablets, mobile devices, Internet connections, video equipment, multimedia projectors, etc.); 2) specialized digital educational resources that take into account the specifics of physical education; 3) integrated management systems that ensure the digitalization of key aspects of the university's activities, including: distribution of teaching load, accounting for scientific publications; financial management of the university's activities; management; electronic documentmanagement; organization of the educational process; coordination of research work; methodological support; automation of the student recruitment process, i.e. the digital educational environment should cover all areas of activity of the educational institution: the educational process, administrativeyu, and managerial,research воспитательную and educational worky. Naturally, the formation of such an environmentdepends to a certain extenton the development of scientific and technological progress, the level of development of informationand communication technologies, including such advanced technologies as artificial intelligence, neural networks, virtual and augmented reality technologies, distributed registry systems, quantum computing, advanced manufacturing technologies, elements of robotics and sensor systems as well as wireless communication technologies, which are called "End-to-end technologies" [6].

It should be noted here that the digital transformation of education and the formation of the digital educational environment of each university has taken place and is currently taking place on the basis of the transition from the beginning of computerization, to the use of information technologies, and already at the present stage to digital transformation. Большое значение для формирования цифровой образовательной of course, access to the global Internet is of great importance for the formation of a digital educational environment,. It is significant that already in 1999, more than a hundred Russian universities began to actively use the Internet in their educational, scientific and methodological activities. Among these advanced educational institutions was Udmurt State University, where the introduction of the Internet significantly accelerated the development of its capabilities to optimize the educational process and research work of university students, including students of the Institute of Physical Culture [13].

Multimedia digital educational resources developed by teachers are of great importance for students of the "Physical Culture" training area: training and monitoring programs, courses for distance learning, mobile applications and other materialsthat act as new learning tools and methods of organizing classes, as pedagogical tools that allow achieving the intended goals [1, 8, 9, 11].

The preparation of teaching materials related to both the creation and use of modern digital educational resources is important in the formation of digital literacy among future professionals in the field of physical culture and teachers, who, in the context of the digital transformation of sports and pedagogical education, need to master the skills of both developing and applying such resources in their professional practice. In this aspect, the creation of the first textbook "Information Technologies in physical culture and sports", which has passed a number of reprints, played a significant role in shaping the digital educational landscape in the field of physical culture and sportse и спорте[4, 7].

Moreover, the accumulated knowledge in the development and implementation of digital educational tools in the training of specialists in the field of physical culture and sports was embodied in pioneering dissertation research (O. B. Dmitriev, PhD thesis, 2003, P. K. Petrov, PhD thesis, 2004). The key conclusions obtained in the research process were: they are summarized in the scientific monograph [12].

The introduction of advanced information technologies in the field of physical culture and sports has served as a catalyst for the development of research activity in this area. An important stage in the methodological support of such research was the publication

of the textbook "Fundamentals of scientific and methodological activities in physical culture and Sports" [2], which systematized approaches to conducting scientific work using digital tools.

Udmurt State University regularly acts as a platform for holding All-Russian and international scientific and practical conferences dedicated to the use of information technologies in the field of physical culture and sports.

The results of research carried out under the auspices of the scientific direction "Digital technologies in the field of physical culture and sports"are a valuable source for the research and teaching staff of the university in the framework of digital modernization of physical culture education. These results, available in an electronic version, are available on the university's website at: http://itsport.school.udsu.ru/.

In recent years, artificial intelligence and neural networks have become widely used in solving various professional tasksнных , which will also solve many problems facing students and teachers, and here, as with many digital information technology tools, it is necessary, first of all, to consider them not as a substitute for a teacher, teacher, trainer,etc. and as assistants that allow you to solve professional tasks more effectively [13].

The analysis of the directions of digital transformation of education and the means of its implementation at Udmurt State University allowed us to identify the main tools that represent the structure of the digital information environment, which can be divided into four blocks: organization of the educational process, organization of research activities, administrative and managerial activities and educational work. All work on the creation and functioning of a digital educational environment, which is an " Integrated Information and Analytical System "(IIAS), is carried out on the basis of technological support: hardware and software. The main source of information in the digital educational environment is the university's website (https://udsu.ru/).

So, for example, the organization of the educational process is linked to such sections as the personal account of the student and teacher, where, depending on whose account, you can use with different information. Students have access to study plans, work programs of disciplines, class schedules, results of tests and exams, portfolios, etc. Teachers can access information about group lists, electronic lists, work programs and assessment funds, teaching load, publications, etc. In the "Learning" section, distance learning courses are available for students and teachers, which teachers develop and use in their own disciplines. An important task in the organization of the educational process is the availability of electronic library systems (EBS) such as EBS"Yurayt", EBS"UdNOEB", EBS"Znanium", EBS"IPR SMART". Educational and scientific laboratories, computer classes, and multimedia classrooms with Internet access are also connected with the organization of educational work. Of great importance in the university's activities is the "Admission" section, which contains all the main documents and technologies for admission of applicants. For the organization of scientific activities, sections of the website "Science" are available, where you can get acquainted with news, organization and holding of scientific and practical conferences and exhibitions, grants and competitions, get acquainted with scientific schools of teachers and scientific publications of the university, youth science, postgraduate and doctoral studies, etc. The "Anti-plagiarism University" system is available for checking the originality of articles and students' research papers. Here it should be emphasized that the role of the scientific block, first of all, is to attract students to research activities. The administrative and management unit is responsible for the activities of institutes and faculties, departments, is engaged in the formation of the academic load of teachers, the activities of educational and methodological management, planning and budget management, the state and development of material and technical support, etc. Educational work, first of all, is carried out in the process of performing educational, scientific, sports and mass cultural work. In addition , such site pages as "Sports Club", "Council of Veterans", etc.

As can be seen from the analysis, it should be noted that the digital educational space comprehensively contributes to the formation of professionals for an innovative economy, and is constantly being improved depending on the goals set, content, means and methods of teaching and upbringing, and organizational forms of their implementation.

However, today there are also new problems associated with both the specifics of the "Physical Culture" training area and the transition to a new higher education system [5].

First, the direction of training "Physical Culture" refers to practice-oriented, i.e. in the process of training students, especially in sports and pedagogical disciplines, there is a combination of different types of training: theoretical, physicaloй, technicaloй, methodologicaloй, research, which requires the formation of universal (soft skills) and professionalx skills (hard skills), which also requires the development of appropriate criteria for assessing the formation of

these competencies. Secondly, появляются внew and new sports are appearing in the Council of Europe, including computer sports and "Digital", which requires their consideration and diversification of physical education [3].

Conclusion. The presence of a digital educational environment, which includes a wide range of innovative author's digital educational materials, creates optimal conditions for training highly qualified personnel in the field of physical culture and sports at all levels of education (bachelor's, master's, postgraduate). This contributes to the effective development of future specialists and teachers ' digital skills, which are critical in the context of the formation of the information society. On the eve of the transition to a new model of higher education in Russia, planned for 2025-2026г., it is extremely important to integrate the accumulated experience of digital modernization of physical education and further improvement of the digital educational infrastructure, taking into account the emergence of new digital sports, such as computer sports and "Digital" on the basis of a modern methodological system of training personnel for the digital economy.

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The shift in students' perspectives on physical activity: the contrasting nature of individual preferences

UDC 796

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Abstract

Objective of the study was to identifying individual and collective preferences for physical activity among students.

Methods and structure of the study. Based on the findings of the Plekhanov Russian University of Economics, a study was conducted among students (n=1272) to explore their physical activity patterns during the academic day. The results were compared with the findings of previous research conducted in 2020-2022.

Results and conclusions. The students are divided into two categories: those who do not engage in physical activity and those who express a desire to lead a healthy lifestyle and participate in physical activity two to three times a week. The use of exercises for general physical development has decreased, with a shift in focus towards preventing posture disorders, developing strength, and improving coordination. Among the students in the second group, we observed a shift in priorities towards a healthy lifestyle, with a strong emphasis on family, school, and university values. The cohort prioritizes physical activity in the comfortable environment of «digital self-isolation». The academic discipline «Physical Culture» is essential for all students, serving as a foundation for the development of a secondary need for physical activity for the first group and a competent approach to exercise selection for the second group.

Keywords: *students, physical activity, installations, personal priorities, university teachers, wellness systems.*

Introduction. The student community, as a socio-demographic group, has distinctive features (culture, values, interests). The influence of constant stressors (intensification of education; technologization and digitalization of society; instability of the geopolitical situation) leads, on the one hand, to a deterioration in students' health, and on the other hand, to the search for new strategies to improve health [1]. In order to modernize physical education taking into account the interests of students, it is necessary to conduct a cohort study of their value-need attitudes and priorities in physical activity.

Objective of the study was to identifying individual and collective preferences for physical activity among students.

Methods and structure of the study. The study was conducted at the Plekhanov Russian University of Economics: literature analysis; empirical research (n=1272) in 2024 (online survey «Physical activity in the daily routine of a modern student»); comparative analysis of students' attitudes towards physical activity (based on the results of research in 2020-2022) [2] and the study conducted; formulation of conclusions.

Results of the study and discussion. A cohort study, as a type of longitudinal research, is used to study a group of people united by a common characteristic (experience) through repeated observations [5]. Student youth are a cohort by age, status (studying at a university), and jointly experienced (COVID-19) and experiencing life events (geopolitical situation).

The concept of «attitude» is interpreted as an individual's readiness to implement a current need, expressed in a person's internal position (value orientations) in relation to events and facts [4].

Based on the concept of «priorities», showing the importance, primacy of something; personal priorities

are guidelines that help an individual make decisions to achieve a certain goal [3].

According to the results of previous studies (during the period of measures (COVID-19), the transition from distance to blended learning), students, under the influence of stressors, experienced a change in life priorities (in communication, physical activity, use of gadgets) [3].

The next repeated online survey (n = 1272) in the 2024-2025 academic year made it possible to obtain new data on the priorities and readiness of young people for various types of activities in the daily routine. A comparative analysis of sociological studies made it possible to consider changes in the physical activity of students in the school day and week. There have been changes in the physical activity of students (Figure 1): a decrease in daily physical activity due to students switching to full-time education (travel time), choosing life priorities (study, rest); an increase in physical activity two to three times a week, which indicates a desire to lead a healthy lifestyle.

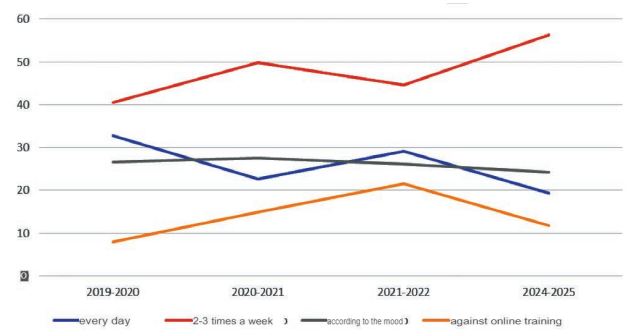

Figure 1. «How often do you engage in physical activity?»

The adaptation of students to life in a situation of uncertainty (instability of the geopolitical situation) and the importance of strengthening psychophysical health for self-realization in modern society can act as a factor in increasing physical activity.

The wave-like trend of increasing and decreasing negative attitudes of students towards online training is due to their adaptation to the conditions of social distancing, adaptation to life in conditions of offline isolation and online communication.

There is a constant increase in the number of students who do not engage in physical activity, a decrease in daily morning exercises and physical exercise complexes (PE), which leads to a decrease in the level of health (Figure 2).

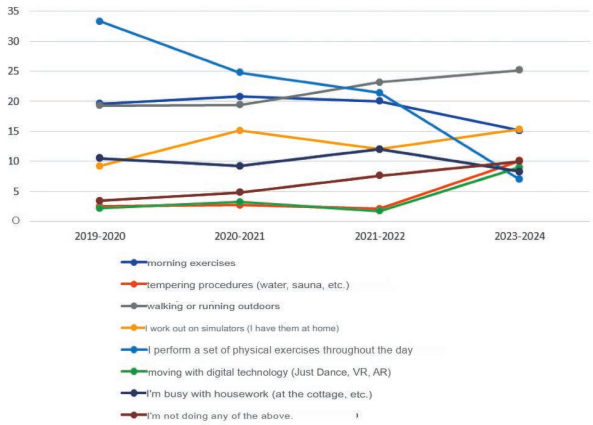

Figure 2. «Your preferences in types of physical activity»

The priority indicators for home exercise equipment training indicate changes in attitudes towards physical activity:

- an increase (2020-2021) in the number of training sessions compared to 2020 is due to the desire to engage in physical education in any life circumstances;
- a decrease (2021-2022) is due to the desire for offline communication;
- an increase in the indicator (2023-2024) and a return to the results of 2021-2022 is explained by the desire to exercise in social isolation.

It is worth paying attention to the indicators: «physical activity using digital technologies» and «hardening procedures»:

- a decrease in the priority of these areas in 2021-2022 is due to the desire to exercise offline (teachers and fellow students);

The students' choice of physical exercises is presented in the table.

Priority areas for the use of physical exercises	2019-2020, %	2020-2021, %	2021-2022, %	2023-2024, %
Development of strength abilities	16,7	14,5	18,6	20,6
Prevention of posture disorders	8,1	11,2	13,6	21,9
Development of coordination	3,1	2,7	3,6	15,7
Development of flexibility	11,1	9,9	9,0	14,8
General physical development	61,0	61,7	55,2	27,0

- an increase in indicators in 2023-2024. indicates the desire of students to lead a healthy lifestyle in comfortable self-isolation (hardening, sauna, «digital» physical activity on exercise machines and in the fresh air).

The following health systems were identified as priorities for students: «stretching» (21,5%) and «healthy back» (20,2%) (Figure 3).

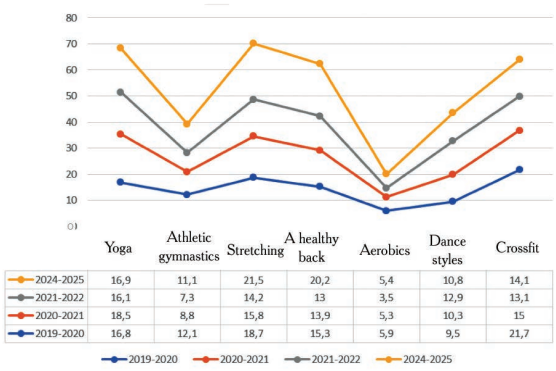

Figure 3. Priority health systems of physical exercises

There is a decrease in the use of physical exercises aimed at general physical development, priorities are shifting to:

- posture prevention (21,9%) due to a sedentary lifestyle;

- strength development (20,6%) due to the fashion for a beautiful physique;

- coordination development (15,7%), which indicates both a conscious understanding of the decrease in coordination abilities and the choice of exercises based on interest, and not the rational use of all physical exercises that teachers can recommend, but not online sources.

Thus, students are divided into groups: the first group does not engage in physical activity; the other shows a desire to lead a healthy lifestyle and physical activity in self-isolation (walking and running in the fresh air, hardening, stretching and healthy back exercises). The second group of students was found to have a healthy lifestyle based on value orientations (family, school, university) and a cohort priority in the implementation of physical activity (two or three times). Personal priorities (in conditions of comfortable «digital» self-isolation) are divided into the following areas: exercise machines; walking and running in the fresh air; hardening procedures; performing exercises to form posture, develop strength and coordination.

Conclusions. It is necessary to indicate the importance of compulsory classes within the framework of academic disciplines (modules) in physical education for all students:

- for students of the first group (loss of primary need) in order to form a secondary need for motor activity;

- for students of the second group in order to take a competent approach to the choice of physical exercises and consulting assistance from university teachers.

Priorities in physical activity show the students' focus on improving their health, but there is a lack of knowledge in the field of physical education for independent preparation for successful professional self-realization and protection of the country's interests.

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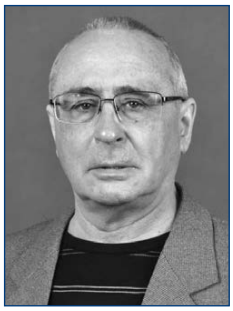
Physical abilities of students with different years of volleyball training

UDC 796.332



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Abstract

Objective of the study was to trace the changes in the physical fitness of university students during their lessons in the volleyball section.

Methods and structure of the study. Thirty-two clinically healthy male university students were examined. Standard tests were used with calculation of Student's criterion on their results.

Results and conclusions. Students who started volleyball training initially had low physical abilities. As the length of volleyball training increased, the students improved the results of all applied tests. After 9 months of training, volleyball players had the highest results in all physical ability tests. Regular long-term training in the volleyball section provides an opportunity to obtain significant progress in the level of physical abilities of students, stimulating the reserves of their internal organs, which contributes to the growth of their intellectual potential. The achieved effects contribute to increasing the efficiency of their learning process at the university and thus improve the quality of training of future professionals of their work, capable of long-term fruitful labor.

Keywords: *volleyball, sports, physical activity, boys, students, physical activity, sectional training.*

Introduction. The necessary component of the student's life during the university is a sport that can develop his physical and strong -willed qualities [1, 2]. Group playing sports remain attractive to young people and therefore are considered as the most effective in relation to the physical development of those involved [3]. In addition, an increase in mental potential noted under these conditions is an important basis for achieving greater effective youth training at the university [4]. This circumstance reinforces the opinion on the need for regular physical training of students who are studying at a university, especially in full -time undergraduate [5].

Modern coaches note the need to continue the development of training schemes in game sports with their mandatory regularity and continuity [6]. Their high effectiveness is recognized in terms of physical improvement even without participating in competitions of any level [7].

The presence of systematic loads for the young organism acts as a powerful stimulating effect on all body systems [8]. They can have a very pronounced effect on the bone-muscular system, nervous system, heart and blood vessels [9]. At the same time, the influence of such training on the youthful organism of students who expressed a desire to regularly train in the volleyball sections at a time free from the educational process requires clarification.

Objective of the study was to analyze the changes in the physical fitness levels of university students participating in volleyball classes.

Methods and structure of the study. To implement the study, 32 clinically healthy male university students (19,2±0,32 years old) of full-time educa-

Physical fitness of volleyball students

The terms of accounting for parameters	Test results, M±m				
	Speed test, since	General endurance test, beats/min	Balance test, sec	Strength endurance test, sec	Joint mobility and flexibility test
Initial, n = 32	33,2±2,16	134,4±3,49++	8,26±0,63	74,7±1,68	46,5±0,92
After 3 months, n = 32	34,6±1,12	129,8±4,05++	7,62±0,72+	83,8±1,52	49,3±1,01
After 6 months, n = 32	33,4±2,26	115,2±1,52*	7,06±0,58*	94,5±2,02**	55,6±0,87*
After 9 months, n = 32	36,7±2,05*	104,6±1,23**	6,87±0,61**	103,6±1,31**	61,3±0,7**

*Note: The reliability of the dynamics of indicators in comparison with the outcome is *-p <0,05; **-p <0,01.*

tion at the beginning of their second or third year, who had not previously been involved in sports, who started regular volleyball training three times a week in the specialized section and attended it at least until the end of the academic year, that is, for nine months. During the sports training, the students were under the dynamic control of the researchers and underwent a set of tests of their physical abilities initially, after three months, after six months and after nine months of classes in the section. These tests were used to evaluate the development of dynamic balance (performing turns on a gym bench), speed (running with a high hip), general endurance (the Kersch test), strength endurance of the abdominal and leg muscles, joint mobility and spinal flexibility. All the results found have been processed using the Student's criterion.

Results of the study and discussion. The testing carried out in the work was summarized in the form of a table.

At the beginning of the study, the students' overall endurance was low, as shown by the results of the Kersch step test. However, after three months of volleyball training, their endurance increased by 3,5%. After six months, it increased further by 16,7%, and nine months later, it had increased by a total of 28,5% (p<0,01).

Initially, the speed characteristics of the students were low (33,2±2,16 times), but after three months of training, the speed test score increased by 3,0%. After six months, the increase was 6,6%, and after nine months, it reached 10,5% (p<0,01).

During regular training, we noticed a gradual improvement in dynamic balance. The indicator for this test increased by 8,4% after three months in the volleyball class, 16,9% after six months, and 20,2% after nine months.

The initially low level of strength endurance development (74,7 ± 1,68 seconds) gradually increased during training. After three months of training, it increased by 12,2%, and after six months, it increased by an additional 26,5%. After nine months, it exceeded the initial level by 38,6%, which confirms the development of boys' physical parameters (p < 0,01).

Volleyball training has proven to be effective in developing mobility and flexibility. At the time of testing, these parameters exceeded the initial levels by 6%, 13%, and 32%, respectively, confirming the development of motor abilities (11).

During the observation period, all students who participated in volleyball activities noted not only a general improvement in strength, but also an increased immunity with a significant reduction in colds. In addition, there was an improvement in academic performance, with a higher percentage of "good" and "excellent" grades compared to the control group. The volleyball players also reported a significant increase in interest in their future professional pursuits, indicating an intensification of intellectual development among young men.

Conclusions. Regular physical activity during sports exercises all the physical capabilities of the body. It was possible to identify a gradual increase in the indicators of physical fitness, who occupied the volleyball of the studios. The data obtained give reason to recommend that students have to study at the university in the university in the volleyball section in order to generally physical strengthening, toning the nervous system and the intensification of preparation for future professional activities.

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Content and organization of physical education of students based on the use of dance sport tools

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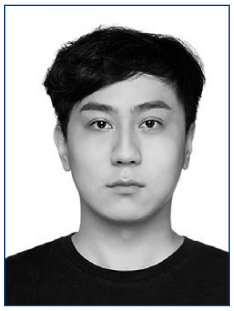

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Abstract

Objective of the study was to theoretical and experimental substantiation of the effectiveness of the model of content and organization of physical education of students using dance sport in the socio-cultural environment of the university. The authors developed a model that includes: target, conceptual and methodological, content, organizational and activity and evaluation and result blocks. The authors proposed organizational forms of educational and extracurricular activities, program and methodological support for an elective course in physical education and sports and an optional course (dance sport module and optional dance sport) in the socio-cultural environment of the university.

Keywords: *content and organization of physical education, means of dance sport, model, students.*

Introduction. In the modern conditions of social development, when the emphasis is on the harmonious development of the individual, physical education in the university acquires special significance. This is not just a set of activities aimed at improving physical fitness, but also an important element in the formation of general culture, social adaptation and psycho-emotional stability of students. In this context, the integration of dance sport into the physical education system opens up new prospects for increasing the effectiveness of the educational process [3, 5]. Dance sport, being a synthesis of physical activity, art and aesthetics, has a unique potential for influencing the individual. It not only promotes the development of physical qualities such as endurance, strength, flexibility and coordination, but also forms a sense of rhythm, musicality, artistry and the ability to express emotions through movement. The inclusion of dance sport in the physical education program makes classes more attractive and interesting for students, which, in turn, increases their motivation for classes and forms a sustainable need for a healthy lifestyle. The creation of a model for the organization and content of physical education of students using dance sport in the socio-cultural environment of the university makes it possible to form a common vision of the process, establish clear goals and theoretical principles, determine the relationships, sequence and influence of key elements of the structure, and establish performance indicators for the activities being implemented. This algorithm of actions allows us to predict and gradually integrate dance sport into the process of physical education of students in the context of the socio-cultural environment of the university [4].

Objective of the study was to theoretically and experimentally substantiate the effectiveness of the model of content and organization of physical education of students using dance sport in the conditions of the socio-cultural environment of the university.

Methods and structure of the study. The formative pedagogical experiment was conducted in the 2024-2025 academic year at RUDN University. At the beginning of the experiment, the number of groups was: EG-29 (9 boys, 20 girls), CG-29 (11 boys, 18 girls) first-year students assigned to the main medical group for physical education.

Results of the study and discussion. We have developed a model that includes: target, conceptual and methodological, content, organizational and activity, and

evaluation and results blocks. The model substantiates various organizational forms of educational and extracurricular activities, and develops software and methodological support for an elective course in physical education and sports and an optional course (dance sport module and optional course in dance sport) in the conditions of the socio-cultural environment of the university (Figure 1).

The development of pedagogical models emphasizes the importance of planning and provides tools for the implementation of relevant educational methods based on progressive theoretical principles.

The key element of the model is the formulation of goals and objectives detailing its target component. This block reflects the public demand for the formation of positive motivation for regular physical activity in university students. The modern socio-cultural environment at the university is a changing system that presents updated requirements for the structure and organization of physical education of students. Innovative content of physical education should take into account the specifics of this environment and promote the comprehensive development of the student's personality.

The socio-cultural environment of the university, being part of the general university environment, is focused on satisfying personal needs and interests in line with universal and national ideals. It is a space capable of transformation under the influence of participating entities that develop and support certain values, relationships, customs, regulations and norms in various areas and forms of activity of the university community [2].

The conceptual and methodological block of the model combines principles and approaches that determine the conceptual foundation that determines the ways to achieve the stated research goal [1].

For the effective implementation of the model, the module «Dance Sport» for the discipline «Elective Courses in Physical Education and Sports» in the amount of 66 hours per year (55 hours of contact work - 1 semester, 15 hours of contact work - 2 semester), as well as the optional course «Dance Sport» in the amount of 36 hours (2 semester) were developed and implemented. The developed curriculum specifies the content of subject topics and the distribution of academic hours for their study. The program of the optional course consists of three modules: Module 1. Ballroom Dance. European Program; Module 2. Ballroom Dance. Latin American Program. Module 3. Fundamentals of Modern Choreography.

Each module includes the following sections: physical training, musical and movement training, educational choreography, technical fundamentals of dance. The formative stage of the pedagogical experiment on the implementation of the model of content and organization of

<table>
<tr><th colspan="6">1 - TARGET BLOCK</th></tr>
<tr><td>Target</td><td colspan="5">Promoting the physical, mental and social development of students through effective integration into the socio-cultural environment</td></tr>
<tr><td rowspan="3">Tasks</td><td colspan="5">Educational objectives Teaching basic knowledge and skills in dance sport; Formation of knowledge about the influence of dance sport on the human body, about the methodology of independent dance sport classes; Development of aesthetic taste and sense of rhythm; Formation of an idea of dance sport as a means of active recreation and social integration.</td></tr>
<tr><td colspan="5">Developmental tasks: Development of physical qualities necessary for successful dance sport. Development of mental qualities (attention, memory, will, persistence, determination and self-control). Development of creative abilities and the ability to improvise. Development of communication skills and the ability to work in pairs or a team.</td></tr>
<tr><td colspan="5">Educational tasks: Formation of the need for systematic physical education and sports. Education of moral and volitional qualities. Formation of a healthy lifestyle culture. Instilling interest in dance sport and forming a positive attitude towards classes. Education of a sense of identity and belonging to the socio-cultural environment of the university.</td></tr>
<tr><th colspan="6">2 - CONCEPTUAL AND METHODOLOGICAL BLOCK</th></tr>
<tr><td>Approaches</td><td>integrative</td><td>sportive</td><td>cultural</td><td colspan="2">systemic</td></tr>
<tr><td>Principles</td><td>awareness and activity</td><td>clarity</td><td>availability</td><td>systematic</td><td>sequences</td></tr>
<tr><th colspan="6">3 - CONTENT BLOCK</th></tr>
<tr><td>Content</td><td colspan="2">Module of the curriculum discipline program
"Elective courses in physical education and sports" (66 hours/year)</td><td colspan="3">Software and methodological support for the optional course "Dance Sport" (36 hours, 2nd semester)</td></tr>
<tr><th colspan="6">4 - ORGANIZATIONAL AND ACTIVITY BLOCK</th></tr>
<tr><td>Organizational forms</td><td colspan="2">Educational activities
Content of the program of the elective course in physical education and sports based on the use of dance sport tools, taking into account the motivational preferences of those involved
Software and methodological support for the optional course "Dance Sport"
Conducting physical education breaks using active teaching methods (for example, dance movements to music)</td><td colspan="3">Extracurricular activities
Organization of physical education and sports events: intra-university tournaments, popular dance festival;
Conducting master classes on modern types of dance sport for students, university applicants in order to popularize various areas of training
Participation of students in demonstration performances at events of various target orientations and content within the framework of the educational and socio-cultural work plan of the university (sports tournaments and competitions, creative festivals and evenings, meetings with media personalities, etc.)
Various dance marathons, competitions, flash mobs</td></tr>
<tr><td>Organizational and methodological guidelines</td><td colspan="5">special training of teachers and educators (advanced training, understanding of the specifics of dance sport, knowledge of means, methods and rules); encouragement and stimulation of students' creative initiative; creation of a favorable psychological atmosphere</td></tr>
<tr><th colspan="6">5 - EVALUATION AND RESULTS BLOCK</th></tr>
<tr><td>Criteria</td><td>motor</td><td colspan="2">functional</td><td colspan="2">affective</td></tr>
</table>

Figure 1 – Model of the content and organization of physical education of students based on the use of dance sport in the socio-cultural environment of the university

physical education of students based on the use of dance sport in the conditions of the socio-cultural environment of the university was carried out during one academic year. Analyzing the indicators of physical development, it can be concluded that by the end of the pedagogical experiment, the subjects of the EG statistically significantly differed from the students of the CG in all indicators. The increase in the results of young men in the EG and CG during the pedagogical experiment is shown in Figure 2.

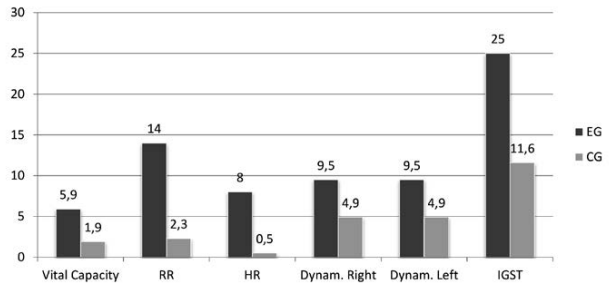

Figure 2 – Increase in physical development and functional fitness indicators in young men of the EG and CG during the experiment, %

The highest increase of 25% was revealed in the IHST indicators characterizing the functional capabilities of the cardiovascular system (physical performance) of the students' body. At the beginning of the experiment, the functional capabilities of the young men in both the EG and CG were at the level of "below average", after the end of the experiment in the EG the level increased to "above average", in the CG positive dynamics are also observed, but the level remained the same. Also, a high increase (14%) in the subjects of the EG was revealed in the respiratory rate indicator, manifested in a decrease in the frequency of respiratory movements per minute, since the lower the respiratory rate, the more economically the oxygen transport system functions. The increase in the results in the functional component of the girls in the EG and CG during the pedagogical experiment is shown in Figure 3.

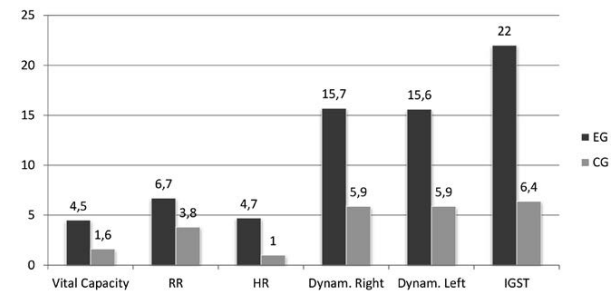

Figure 3 – Increase in physical development and functional fitness indicators in girls of the EG and CG during the experiment, %

The highest increase of 22%, as well as in young men, was revealed in the IGSTI indicators. At the beginning of the experiment, the functional capabilities of both the EG and CG girls were at the level of «below average», after the end of the experiment in the EG the level increased to «average», in the CG positive dynamics are also observed, but the level remained the same. Also, a high increase (15,7% and 15,6%) in the EG female students was revealed in the indicators of wrist dynamometry, manifested in an increase in the number of kilograms, which indicates the degree of physical development, since the force of contraction of individual muscle groups (the level of strength of the flexor muscles of the hand) is proportional to the development of the entire muscular system as a whole. In the indicators of vital capacity of the lungs, both in young men and girls, the increases were not significant. In our opinion, this fact is due to the fact that VC as an important functional indicator depends on gender, age, body size, as well as on many factors, including the climatic and geographical zone of the place of residence. To study the physical fitness of students (motor component), we conducted testing on seven tests of the All-Russian Physical Culture and Sports Complex GTO level 7 (18-19 years old) and tests characterizing coordination fitness (Figure 4).

Analysis of the obtained data showed that the presented quantitative parameters can be characterized as follows. The young men of the EG out of 6 tests of the All-Russian Physical Culture and Sports Complex GTO completed 4 exercises for a bronze badge, completed 2 exercises for a silver badge, the young men of the CG completed 5 exercises for a bronze badge, and in the exercise «Bent on a gymnastic bench» the subjects failed to meet the standard.

Analysis of the data presented in Figure 3 shows that the highest increase (160%) occurred in the control exercise on flexibility, which is natural, since dance exercises affect the flexibility of the ligament-muscle apparatus of a person, and an insufficient level of muscle flexibility can lead to chronic pain, frequent ligament ruptures and other negative consequences. The study showed that high increases were also detected in the control exercises on the function of static and dynamic balance. Despite the fact that both in the EG and in the CG most of the control exercises were performed for the bronze badge, in the EG the increases in indicators were significantly higher than in the CG (Figure 4).

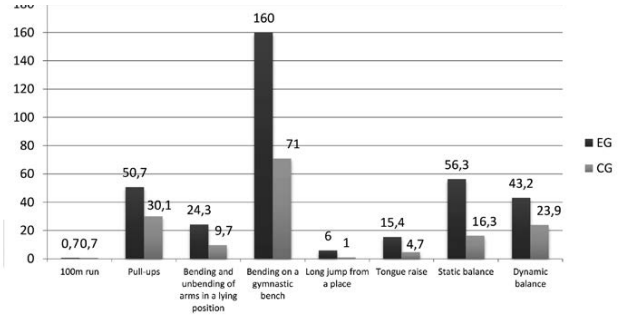

Figure 4 – Increase in physical fitness indicators of young men in the EG and CG during the experiment, %

The smallest increase in both the EG and CG was found in the speed ability test (excluding 100m). In our opinion, this fact is quite natural and is explained by the determinism of this ability, as well as the predominant focus of dance training on other motor abilities.

By the end of the pedagogical experiment, the EG students out of 6 tests of the All-Russian Physical Culture and Sports Complex GTO met 2 standards for a gold badge, 3 standards for a silver badge and one standard for a bronze badge, while the CG students met one standard for a gold badge, 2 standards for a silver badge and 3 standards for a bronze badge. It should be noted that the percentage of standards met by girls is higher than that of boys.

Additional arguments are the percentages of increase in the studied indicators (Figure 5).

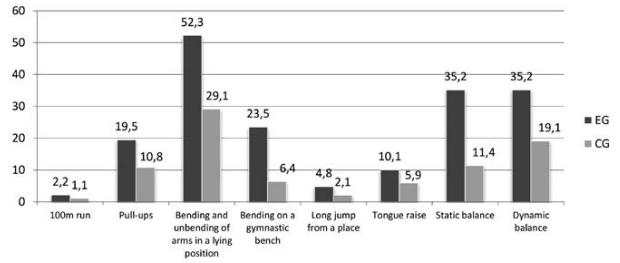

Figure 5 – Increase in physical fitness indicators of girls in the EG and CG during the experiment, %

The highest increases in the EG were noted in the control exercise «Pull-ups from a hanging position on a low bar» (52,3%) and «Bending and unbending arms in a lying position» (19,5%), reflecting the development of speed-strength abilities, as well as in the flexibility test (23,5%) and in tests of the ability to maintain balance (35,2%) (Figure 5).

Conclusions. Thus, the content of physical education of students developed by us based on the integrated use of Chinese health practices is a set of interrelated structural components that reveals the process of physical education of students from the standpoint of target orientation, content, organization, and assessment of effectiveness.

Distinctive features are:

- integrated use of Chinese health practices taking into account their educational and health orientation;
- a combination of educational and extracurricular forms of organizing the physical education process;
- the use of special methodological techniques aimed at stimulating and activating the motor and cognitive activity of students.

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Digital transformation in sports – currente trendsы and trends

UDC 796:004.93

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Abstract

The aim of the study is to identify trends and trends in the digital transformation of the sports industry based on content analysis of current publications of the journal "Theory and Practice of Physical Culture".

Methodology and organization of research. In the course of the work, a content analysis of the publications of the journal "TandPFC" for the period 2024 was carried out. The item is selected as the invoice unit. A total of 28 articles were selected on the use of digital technologies in sports and physical education of students.

Research results and conclusions. Based on the results of content analysis, the main trends in the development of digital transformation of physical culture and sports are identified: digitalization and virtualization in education, digitalization and virtualization in sports, gamification, artificial intelligence and machine learning. The current state of manifestation of the considered trends causes the formation of digital transformation trends, among which the key ones are: the use of wearable digital devices for monitoring the physical state of a person in education and sports, the use of mobile applications in training and managing the training process, the use of machine vision technologies in analyzing and modeling athlete movements, the development of phygital sports.

Keywords: *digital transformation, sports sphere, education, digital technologies, state, prospects.*

Introduction. To make forecasts for the future, modern research regularly turns to the analysis of various trends and trends emerging in society.

At the same time, it should be noted that these two concepts differ significantly from each other. Translated from English, trend –means "trend", "current", "direction"that occurs here and now. On theother hand, it captures events in real time and reflects the direction of changes in something. In this regard, the life cycle of the trend is shortм and spasmodic.

A trend, unlike a trend, is a phenomenonthat develops in the long term under the influence of certain factors. In other words, it is an established (sustainable) направледirection of development of any process, which is no longer new in the current situation. Based on trends, you can predict what исследуемое the phenomenon under study will expect in the future.

Comparing the concepts under consideration, it can be argued that the preservation and development of a trend depends on the context of the trends that fill it. For example, the trend of forming and maintaining a healthy lifestyle is based on social, natural, and technological trends: expanding scientific discourse, supporting the state, creating health centers, developing technologies, and so on.

Thus, in the conditions of rapidly changing scenarios of modern life, the model of development of any public sphere is built taking into account the forecastingя ofpositive trendsй for a long time based on the analysisa of current trends in social phenomena.

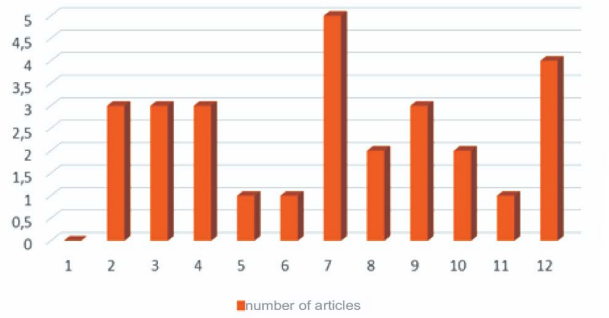
In the field of sports, digital transformation hasalready become a steady trend, rooted in various fields. Sport is a fast-changing world, where the main result is to achieve victory and leadership. Therefore, it is now

important to identify trends and trends that contribute to the progressive development of the sports industry.

The aim of the study is to identify trends and trends in the digital transformation of the sports industry based on content analysis of current publications of the journal "Theory and Practice of Physical Culture".

Methodology and organization of research. In the course of the work, a content analysis of the publications of the journal "TandPFC" for the period 2024 was carried out. The following semantic categories were chosen: digital technologies, platforms, applications; digital transformation area (training process, organization ofcompetitions, education, healthy lifestyle, management), efficiency and prospects of digital transformation; participants (athletes and coaches, eventorganizers,spectators and fans, teachers, students,technologydevelopers). The item is selected as the invoice unit. A total of 28 articles were selected on the use of digital technologies in sports and physical education of students.

Research results and their discussion. Analysis of the distribution of articles by number showed that articles of the studied topic were systematically published during the year – on average, two-or three publications in each issue, whichaccounted for 6% of the total publication content (Fig.)



Distribution of articles on digital transformation in physical culture and sports by "TiPFC"numbers

B The analysis revealed that research in the field of digital technologies in the field of FKiSis mainly conducted in scientific schools in Moscow (8 units), St. Petersburg (4 units), Izhevsk (4 units), Tomsk (2 units) and Ulyanovsk (2 units).

Studying the topics and content of content reflecting various aspects of the digital transformation of the FKiS allowed us to determine the main trends in the development of this process:

- digital transformationand virtualization in education;
- digital transformationand virtualization in sports;
- didentification.
- both artificial intelligence and machine learning.

The identified trends характеризуюare characterized by stable time dynamics, a high degree of technology development and their active implementation in the field of physical culture and sports, taking into account the long-term perspective.

The current state of manifestation of the considered trends causes the formation of digital transformation trends, among which the key ones are: the use of wearable digital devices for monitoring the physical state of a person in education and sports, the use of mobile applications in training and managing the training process, the use of machine vision technologies in analyzing and modeling athlete movements, and the developmentof.

These trendsюindicate a growingpublic demand for a personalized approach to training and sports training and their accessibility, which can be achieved through wearable devices and mobile applications. The use of artificial intelligence technologies contributes to improving the accuracy of analytics in the study of human body movements and making decisions based on it to improve the results of sports activities. The trend towards integrating the virtual and real world expands the opportunities for audience engagement and creating new formats for sports events.

Conclusions. The conducted research of the current content «of the "TiPFC" magazine» has shownothat in the digital transformation of the field of physical culture and sports, stable trends have been formed, which today are becomingpromising directions in building a strategy for the development of the industry. Unlike trends, trends allow us to assess the state and nature of the demand for digital tools in solving current problems of physical culture and sports. At the same time, technological trends determine the vectors of future research and the formats of sports practice in order to increase the effectivenessof the trainingprocess, improve the analysisof big data, popularize sports events, and find channels for successful network interaction субъектов between sports industry entities.

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Correlation of trends and trends of digital transformation in the field of physical culture and sports based on the topics of articles of the "TiPFC" magazine

Issue of the journal	Topic	First author	Trend	Trend
2	Virtual technologies in professional training of student-athletes: assessment of functional indicators and competencies	A. P. Shmakova, Ulyanovsk	Digitalization and virtualization in education	Introduction and use of virtual and digital technologies in professional training of students-athletes and future specialists of FKiS
2	Digital technologies in physical education of students: experience of using a mobile application	A. A. Yeghiazaryan, Moscow, Yerevan	Digitalization and virtualization in education	Using mobile applications, digital platforms and online services in training and for managing the training process
2	Assessment of psychophysiological indicators of esportsathletes, winners of the international esports festival "Battle for Science" 2023	L. S. Shuvalova, Moscow	Digitalization and virtualization in sports	Data monitoring and analysis technologies
3	Digital image of sports mega-events in the media feed and social networks	A. A. Belov, Yekaterinburg	Digitalization and virtualization in sports	Using digital technologies to promote sports and involve young
people 3	Formation of digital competence in the scientific research of a master's degree student in the field of professional education in the field of physical culture and sports .	T. A. Pike, Dace	Digitalization and virtualization in the formation	, Implementation and use of virtual and digital technologies in the training of student-athletes and future specialists of physical culture and sports
Of 3	Digital educational process in the discipline "Physical culture and sport: an elective form of volleyball	M. H. Housew, Nalchik	Digitalization and virtualization in education	the Use of mobile apps, digital platforms and online services in training and management of the training process
4	Sports metallene: theory and practice	E. N. Skarzynska, Moscow	Gamification	Implementation of game elements (gamification) in recreational and sports activities
4	Rationing exercise on the basis of the digital data to wearable device	A. A. Kovalev, Kaliningrad	Digitalization and virtualization in sports	the Use of mobile applications digital platforms and online services in training and management of the training process Using wearable devices to collect data about physical activity and functional performance of athletes monitoring Technologies and data analysis
4	the use of the technologies of computer vision in monitoring of physical activity of children	and I. I. Novikov, Omsk, Novosibirsk	Artificial intelligence and machine learning	, the Use of artificial intelligence (AI) to analyze data plan your workouts and increase the effectiveness of training in monitoring and data analysis
5	features of application of digital technologies in technical and tactical training of volleyball players a massive discharges	L. A. Filippolslands, Ulyanovsk	Digitalization and virtualization in sports	the Use of mobile apps, digital platforms and online services in training and management of the training process
6	Artificial intelligence in providing the first and second signal systems incorporates a sensor-agnostic information to fine-Kooof rdinatio action volleyball	M. H. Housew, Nalchik	Artificial intelligence and machine learning	, the Use of artificial intelligence (AI) to analyze data plan your workouts and increase the effectiveness of sports training
7	Digital technology in the program of the all-Russian festival of adaptive physical culture and sport "Blurring the lines"	Jo Karmazinskiy, Moscow	Digitalization and virtualization in sports	Development digital technologies (combination of physical and digital) in sporting events and educational programs
7	prospects for the development of digital sports in the system of higher education	N. N. Sataeva, Surgut	Digitalization and virtualization in education	Development digital technologies (combination of physical and digital) in sporting events and educational programs

7	Organizational model of digital learning ecosystem for physical culture and sports at the University	of tn. Shutova, Moscow	Digitalization and virtualization in education	the Use of mobile apps, digital platforms and online services in training and management of the training process
7	Automated collection system and differentiated assessment of functional and special physical preparedness of swimmers of different skill level	I. N. Solopov, Moscow	Digitalization and virtualization in sports	monitoring Technologies and data analysis
7	Digital educational content "Moscow electronic school" in the training process of students of	S. V. Kolotilova, Moscow	Digitalization and virtualization in education	the Use of mobile apps, digital platforms and online services in training and management of the training process
8	system Capabilities "motion capture" to identify the characteristics of technology pedaling bicyclists	V. P. Sushchenkov, Saint Petersburg	Artificial intelligence and machine learning	Application of artificial intelligence (AI) for data analysis, training planning and improving the effectiveness of sports training
8	Improving the effectiveness of yawl rowing techniques with a rolling system based on kinematic analysis and computer modeling	TA. Sheychenkovao, St. PetersburgUSG	Artificial intelligence and machine learning	Application of artificial intelligence (AI) for data analysis, training planning and improving the effectiveness of sports training
9	Digital Festival as a new format for promoting traditional spiritual and moral values among young people	O. A. Dveirina, St. Petersburg	Digitalization and virtualization in education	Development of digital9
9	Structure of the elective course on physical culture "Winter Football" with the use of digital technologies	L. V.Kapitovich, Tomsk	Digitalization and virtualization in education	Development of digital technologies (combination of physical and digital) in sports events and educational programs 9 Restoration of partially implemented digital technologies (combination of physical and digital) in sports events and educational programs
9	lost heart rate data based on information about pedaling power in long-term locomotion cycling	E. D. Gorbunov, Moscow	Artificial intelligence and machine learning	Using AI to coordinate athletes ' actions (for example, in volleyball) and restore lost data (for example, heart rate) Application of artificial intelligence (AI) for data analysis, training planning and improving the effectiveness of sports training
10	Application of computer vision methods in improving the effectiveness of training process management for cross-country skiers	N. B. Novikova, St. Petersburg	Artificial intelligence and machine learning	Application of artificial intelligence (AI) for data analysis, training planning and efficiency improvement sports training.
10	Using artificial intelligence in planning physical education classes for students of the special medical group	Yu. A. Karvunis,Tomsk	Artificial intelligence and machine learning	Application of artificial intelligence (AI) for data analysis, training planning and improving the effectiveness of sports training.
11	Requirements for hardware and software support for the digitalization of sports	A.V. Ermakov, Moscow	Digitalization and virtualization in sports	Development of digital technologies (a combination of physical and digital) in sports events and educational programs
12	Formation of a digital educational environment in the system of training specialists in physical culture and sports	P. K. Petrov, Izhevsk	Digitalization and virtualization in education	introduction and use of virtual and digital technologies in the professional training of students-athletes and future specialists of FKiS
12	Online service in teaching students of sports directions to plan training sessions	S. A. Alabuzhev, Izhevsk	Digitalization and virtualization in education	Use of mobile applications, digital platforms and online services in training and management training process
12	Prospects of using neural networks in physical training of Aikido	practitioners A. V. Mikheev, Izhevsk	Artificial intelligence and machine learning	Prospects of using neural networks in physical training
12	Technologies of gamification of physical culture and sports activities in a virtual sports club	O. B.Dmitriev, Izhevsk	Gamification	Introduction of game elements (gamification) in physical culture and health and sports activities

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The future of sports law in the metaverse: a look at the potential for individual sports participation

UDC 34:096

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Abstract

Objective of the study was to assess the legal implications of incorporating the metaverse into the world of sports.

Methods and structure of the study. The fundamental approach to this research is the experimental method. The researchers employed specialized equipment, including a virtual reality headset (MetaOculusQuest – 2), to fully immerse themselves in the realm of virtual reality. This allowed them to recreate a boxing simulation that closely resembled the real thing.

Results and conclusions. The creation of immersive virtual reality simulations of individual sports events demands a substantial mental and physical investment from the user, akin to the effort required for real-world sports. Given the metaverse's potential to encompass numerous virtual worlds, it is reasonable to anticipate that one of these will be dedicated to the realm of sports. The primary legal challenges in integrating the metaverse into the sports industry revolve around issues of identity verification and cheating.

Keywords: *metaverse and sports, virtual sports, digital avatar of an athlete.*

Introduction. It is unlikely that anyone will not agree that all further development of the sports industry will be under the influence of technological progress. Over time, ideological innovations arise that are successfully integrated into the field of sports. Perhaps the greatest interest from the latest digital trends is caused by such a phenomenon as metaverse.

The theme of the symbiosis of the metaverse and sports industry is interested in scientists from around the world. In the vast majority of cases, scientists are interested in the question of the commercial component of integration of the sport in the metaverse. S.S. Chen and D. J. Zhang conducted a study on the key mechanic, which affect consumer demand in sports metavated. As a result, they came to the conclusion that virtual interactions were the most important factor in market demand affecting the intentions to visit the metaverse [2]. Developing a thought presented by the authors, I would like to dwell on the forms of virtual interaction. Throughout the history of the sports sphere, the main catalyst for attracting the audience was the characteristics of the athletes themselves (strength, speed, creativity, perseverance, self -control, etc.) regarding their confrontation during the competition. In this case, we can talk about both team and individual sports. In this regard, there is a clear need to determine how high the connection of the sports competitions held in the metaverse sports competitions with the real world is high, that is, is it possible to consider sport in the metaverse and real world with similar phenomena?

Objective of the study was to assess the legal implications of incorporating the metaverse into the world of sports.

Methods and structure of the study. The authors decided to conduct an experiment to simu-

The data of the experiment

<table>
<tr><td colspan="2"><u>Subject data:</u>
Paul-husband., Age-26 years old, social status-graduate student, teacher, height-174, weight-66, sports experience-7 years of amateur sports (boxing), weekly activities with active sports (mini-football).</td><td>Means</td><td>Simulation app</td></tr>
<tr><td><u>Physical indicators to:</u>
Condition: excellent;
Pulse: 60 beats. in min.
Muscle weakness: absent.</td><td><u>Monday. Physical indicators after:</u>
Characterization of the fight: 3 rounds of 2 minutes, break - 1 min., The level of complexity is average.
Condition: somewhat tired (small sampling).
Pulse: 131 beats. in min.
Muscle weakness: Small.</td><td rowspan="3">Oculusquest 2 (virtual reality glasses + two joystick joysticks)</td><td rowspan="3">The Thrill of the Fight</td></tr>
<tr><td></td><td><u>Wednesday. Physical indicators after:</u>
Characterization of the fight: 3 rounds of 3 minutes, break - 1 min., The level of complexity is high.
Condition: shortness of breath.
Pulse: 141 beats. in min.
Muscle weakness: essential.</td></tr>
<tr><td></td><td><u>Saturday. Physical indicators after:</u>
Characterization of the fight: 5 rounds of 3 minutes, break - 1 min., The level of complexity is high.
Condition: Strong shortness of breath.
Pulse: 150 beats. in min.
Muscle weakness: high.</td></tr>
</table>

late a virtual boxing match using a virtual reality headset. One of the authors acted as a subject (see table).

Results of the study and discussion. Despite the use of a symptulator in offline mode, it is safe to say that the created situation is close to a full-fledged boxing match. In addition to the technical skills of conducting a fight, among which, setting hands and racks, speed and accuracy of shocks (this skill can also be tested in training mode with a boxing bag), the ability to evade the opponent's attacks, to win various tactical schemes (for example, the translation of attacks from the body to the head, dive and entry at an angle, etc.).

The only aspect that needs to be made significantly is to integrate tactile sensations from the opponent's strokes (development in this area is carried out). It may seem that the implementation of this provision occurs only in fantastic cinema and literature, since there is no «sports» component.

On the other hand, not everything is so simple. Here, a study of the large team of Asian scientists who, using special nanogenerators installed on the subjects showed the objective possibility of transforming the human energy produced in the world of virtual reality into the metaverse [4], are very interesting [4].

Thus, scientists have revealed an objective possibility of transferring human energy to a metaverse.

One of the few scientific articles in which attention is drawn to the issues of sports law in the conditions of the development of the metaverse is the study of A.V. Minbaleeva and E.V. Titova, which revealed the general problems of transformation of the legal regulation of the sports industry in the metaverse. Among these are they identified are spheres such as, in particular, the protection and protection of personal data of athletes and the legal regime of virtual stadiums and houses of fans [1]. The most discussed issue in science regarding the subject of sports and metaverse is the protection and confidential data. In this regard, it is very reasonably indicated that the sports industry is important to solve problems and ensure the responsible and ethical use of the metaverse [3].

We are invited to consider this issue in terms of identification of athletes. The peculiarity of conducting sports competitions in the metaverse is determined by the lack of a single physical space. In this understanding, each of the athletes can physically be in familiar conditions. Here the most important question arises of how to identify the personality of the athlete.

In modern society, it acquires/gained popularity of using biometric data in order to certify the individual. The idea of biometric identification of athletes in the metaverse looks very attractive and reliable, provided that the most suitable method is selected. Given the

specifics of the equipment used for access to virtual reality (virtual reality headset) could be proposed to use the retina, which should be fixed on the device throughout the length of the sports distance. In this case, a clear connection with the security and confidentiality of the data is visible, since the retina, like any other biometric data, is one of the forms of personal data.

Another potential problem of conducting sports competitions in the metaverse can be cheating. In essence, cheating suggests an unfair acquisition by the player of any advantages from the use of unauthorized software. It is far from the first decade that the problem of cheating in the field of e -sports has been actively discussed by scientists and e -sportsmen. It is very likely that this problem will gain a new degree of relevance in integration of sports into a metaverse. In the future, it is impossible to exclude the possibility of direct use of cheat codes in the metaverse to increase the sports characteristics of the competition participant. For example, the use of cheat codes will increase the strength and/or speed of the blow or make the participant completely invincible.

A universal and probably the only possible option to avoid the possible use of cheating lies in the proper functioning of the information system, on the basis of which the competition is held. The main role of law is reduced, first of all, to the establishment of a direct ban on the use of cheating and, accordingly, sanctions for its violation. In addition, the use of legal mechanics will establish uniform requirements that the information system must satisfy. Here, the idea arises of establishing the responsibility of the organizers of the competition to obtain a certificate of conformity of the information system with the established requirements, without which it is impossible to conduct legal and recognized competitions.

Conclusions. Metaverse, being one of the main digital trends of the modern world, is fraught with great opportunities for the sphere of sports. A number of scientific research clearly show the objective possibility of transferring the produced human energy to the world of virtual reality. Based on the experiment (the simulation of virtual boxing fights), the authors showed that sports competitions in virtual reality are as close as possible to sports competitions held in the real world. Integration of sports in the metaverse will entail some transformations related to legal regulation.

In this work, two problem areas are identified, which will face sports law: identification of the athlete (proposed to use the retina while using the virtual reality headset) and cheating (indicated to ensure the safety of information systems).

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A collaborative approach to harmonizing online and offline activities for teenagers in the era of digital technology

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Abstract

Objective of the study was to create and theoretically support a synergistic framework for the equilibrium between virtual and physical activities in adolescents aged 12 to 18 in the context of the digital transformation of society.

Methods and structure of the study. Based on the examination of WHO data and the pilot implementation in a sports school (with a sample size of 60), a framework is suggested that encompasses five functional components: educational-methodological, motivational-stimulating, regulatory-infrastructural, diagnostic-adaptive, and socio-cultural. The framework is put into practice through educational initiatives, gamification, digital monitoring systems, and cultural practices. The study employs methods such as literature review, questionnaire surveys, and qualitative data analysis.

Results and conclusions. The preliminary findings of the model evaluation revealed a decrease in screen time of 15-20% and an increase in physical activity of 20-30%. The key principles of operation are a positive feedback loop, dynamic activity planning, and content symmetry. A positive feedback loop fosters motivation by linking digital and physical accomplishments. Dynamic planning personalizes the activity schedule, considering biorhythms, academic workload, and seasonal factors. Content Symmetry offers exercise programs that mirror the time spent on digital devices. The model encourages the development of sustainable motivation for a healthy lifestyle, reducing the risks of physical inactivity and digital exhaustion. The model is still undergoing testing, which will enable us to refine its effectiveness on a larger scale.

Keywords: *synergetic model, balance of activities, teenagers, digital technologies, physical activity, physical inactivity.*

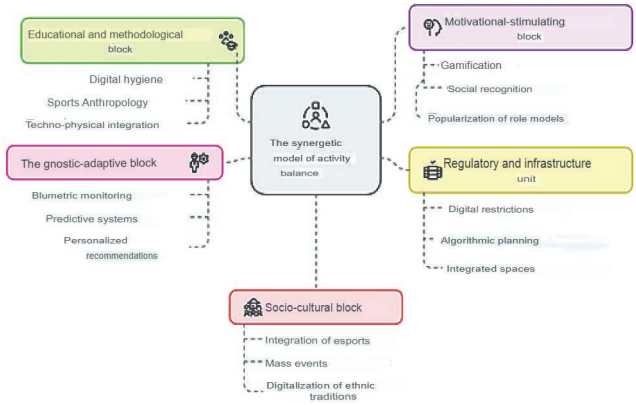
Introduction. Modern teenagers (12-18 years old) They face an anthropo-digital conflict: the technological environment provokes a lack of motor activity [2] and a transformation of value orientations [1]. According to WHO data [6], only 19% of adolescents meet the recommendations for physical activity (at least 60 minutes per day), while the average screen time exceeds 7 hours per day. Traditional pedagogical models that ignore digital habits are losing their effectiveness, which actualizes the development of models that integrate the principles of synergetics [3] and sports anthropology.

Objective of the study was to creation of a collaborative framework to address the disparity between online and offline physical activity among teenagers by incorporating digital resources into the realm of sports.

Methods and structure of the study. The study involved 60 adolescents (12-14 years old), pupils of the specialized educational and sports institution «Children's and Youth Sports School of Petrikovskiy district» (Gomel region, Belarus) at the age of .Selection criteria: absence of chronic diseases, consent to use fitness trackers. Research methods: analysis of WHO data and scientific and methodological literature, data collection through fitness trackers, questionnaires, model design based on a synergetic approach.

Results of the study and discussion. The analysis of current trends indicates a complex and contradictory situation in the field of physical education of adolescents in the digital age. To overcome

these contradictions, it is necessary to innovatively rethink existing approaches and develop new models based on the synergy of digital and physical activities. This will not only reduce the risks associated with physical inactivity and excessive use of digital technologies, but also form a stable motivation among adolescents for a healthy lifestyle and harmonious development in modern digital reality. To resolve the contradictions, we have developed a synergetic model aimed at reducing the imbalance between virtual and physical activity in adolescents through the integration of digital tools into sports culture (see figure).



The structure of the synergetic activity balance model

The structure of the model includes five functional blocks interacting on the basis of the principles of synergetics [4]: an educational and methodological block (teaching digital hygiene, physical culture history), a motivational and stimulating block (gamification (challenges), API integration of achievements in social networks), a regulatory and infrastructural block («digital quarantines», smartschedule), diagnostic and adaptive block (biometric sensors, gamified checklists), socio-cultural block (AR quests, esports with a physical component). At the same time, the model provides key functions: preventive, adaptive, culture-forming (see the table).

The testing of the synergistic model was carried out on the basis of a specialized educational institution «Children and Youth Sports School of the Petrikovsky District» (Gomel region, the Republic of Belarus) with the participation of 60 young athletes at the age of 12-14 years of qualification of the I-III category. The model includes five blocks: educational, methodological, motivational-styling, regulatory and infrastructure, diagnostic-adaptive and sociocultural.

In the educational and methodological block, adolescents received training in digital hygiene, sports anthropology and techno-physical integration. The curriculum included teaching on screen time standards, techniques for switching attention, physical education history and sports benefits for mental health.

To increase the motivation, gamification (Chellengi and virtual awards), social elevators (public recognition for sports successes), popularization of role-playing models and automatic publication of achievements on social networks through the API of fitness trackers were used.

Digital quarantines (zones without gadgets in a sports school), smart schedule (balancing online activity and training), physical and civil spaces (coworking with simulators) and coach bots in messengers for reminders about the breaks and proposals of mini-exercises were introduced.

For monitoring and adaptation, biometric sensors were used to monitor stress, sleep and physical activity, as well as gamified checklists for simplified self-control.

The basis of the sociocultural block was e-sports disciplines with the physical component, flash mobs of mixed reality and ethno -sports measures.

Interim results of testing and their discussion.

1. Participants increased the average physical activity time by 20-30%.

2. The average time spent by participants behind digital devices decreased by 15-20%, which indicates a more rational distribution of time between virtual and physical activity. Reducing screen time is

Distinctive features of the synergistic model from traditional models

Criterion	Traditional models	Synergetic model
Target	Increased load	Balance of activity
The role of the teacher	Controller	Synergy moderator
Tools	GTO standards	AR quests, API integration

consistent with Smith Etal data. [4], which noted the effectiveness of gamification. The growth of physical activity confirms the hypothesis of synergy of digital and traditional methods [5].

3. 78% of respondents noted a significant increase in interest in sports and physical activity due to the use of gamification and social incentives.

Conclusions. The developed model demonstrates the potential for harmonizing the virtual and physical activity of adolescents. Key success factors-integration of sports into digital identity through AR quests and gamification. Research restriction is a small sample. Prospects include the introduction of neuro interfaces and the expansion of testing.

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